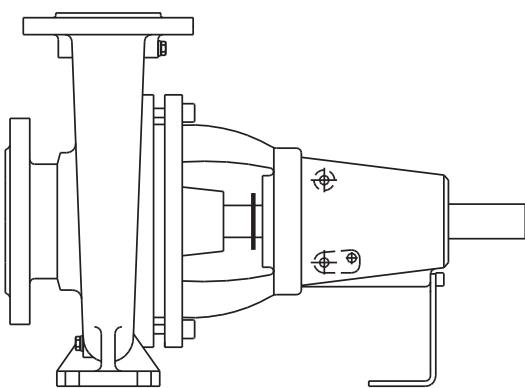


CE

Instruction manual
CombiNorm
Horizontal centrifugal pump
according to EN 733 (DIN 24255)



EC Declaration of conformity

(Directive 98/37/EC, appendix II-A)

Manufacturer

Johnson Pump Water B.V.
Dr. A.F. Philipsweg 51
P.O. Box 9
9400 AA Assen
Netherlands

hereby declares that the pump, in case it is delivered as an assembly with drive (last position of serial number = A), is in conformity with the provisions of Directive 98/37/EC (as altered most recently) and the following directives and standards:

- EC directive 73/23/EEC, "Electric equipment for use within certain voltage limits"
- standards EN 292 part 1 & 2, EN 809

The pump to which this declaration refers may only be put into operation after it has been installed in the way prescribed by the manufacturer, and, as the case may be, after the complete system of which this pump forms part, has been made to fulfil the requirements of Directive 98/37/EC (as altered most recently).

Manufacturer's declaration

(Directive 98/37/EC, appendix II-B)

Manufacturer

Johnson Pump Water B.V.
Dr. A.F. Philipsweg 51
P.O. Box 9
9400 AA Assen
Netherlands

hereby declares that the pump, in case it is delivered without drive (last position of serial number = B), is in conformity with the following standards:

- EN 292 parts 1 & 2, EN 809

and that this pump is meant to be incorporated in or combined with another machine (electric motor, combustion engine) and may only be put into use after the complete machine of which the pump under consideration forms part has been made and declared to comply with that directive.

Assen, January 1st 2004



P. Ressenaar
Director

Instruction manual CombiNorm

All technical and technological information in this manual as well as possible drawings made available by us remain our property and shall not be used (otherwise than for the operation of this CombiNorm pump), copied, duplicated, made available to or brought to the notice of third parties without our prior written consent.

Johnson Pump Water BV (hereafter called Johnson Pump) is part of Johnson Pump International AB. The core activities of Johnson Pump International AB are the development, production, sale and maintenance of pumps and pump units.

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1 Introduction

1.1 Preface

This manual contains important and useful information for the proper operation and maintenance of this pump. It also contains important instructions to prevent potential accidents and damage, and to ensure safe and fault-free operation of this pump.

! **Read this manual carefully before commissioning the pump, familiarize yourself with the operation of the pump and strictly obey the instructions!**

The data published here comply with the most recent information at the time of going to press. However they may be subject to later modifications.

Johnson Pump reserves the right to change the construction and design of the products at any time without being obliged to change earlier deliveries accordingly.

1.2 Safety

This manual contains instructions for working safely with the pump. Operators and maintenance staff must be familiar with these instructions.

Below is a list of the symbols used for those instructions and their meaning:



Personal danger for the user. Strict and prompt observance of the corresponding instruction is imperative!

! **Risk of damage or poor operation of the pump. Follow the corresponding instruction to avoid this risk.**

➤ ***Useful instruction or tip for the user.***

Items which require extra attention are shown in **bold print**.

This manual has been compiled by Johnson Pump with the utmost care. Nevertheless Johnson Pump cannot guarantee the completeness of this information and therefore assumes no liability for possible deficiencies in this manual. The buyer/user shall at all times be responsible for testing the information and for taking any additional and/or deviating safety measures. Johnson Pump reserves the right to change safety instructions.

1.3 **Guarantee**

Johnson Pump shall not be bound to any guarantee other than the guarantee accepted by Johnson Pump. In particular, Johnson Pump will not assume any liability for explicit and/or implicit guarantees such as but not limited to the marketability and/or suitability of the products supplied.

The guarantee will be cancelled immediately and legally if:

- Service and/or maintenance is not undertaken in strict accordance with the instructions.
- The pump is not installed and operated in accordance with the instructions.
- Necessary repairs are not undertaken by our personnel or are undertaken without our prior written permission.
- Modifications are made to the products supplied without our prior written permission.
- The spare parts used are not original Johnson Pump parts.
- Additives or lubricants used are other than those prescribed.
- The products supplied are not used in accordance with their nature and/or purpose.
- The products supplied have been used amateurishly, carelessly, improperly and/or negligently:
- The products supplied become defective due to external circumstances beyond our control.

All parts which are liable to wear are excluded from guarantee.

Furthermore, all deliveries are subject to our "General conditions of delivery and payment", which will be forwarded to you free of charge on request.

1.4 **Service and support**

This manual is intended for engineering and maintenance staff and for those who are in charge of ordering spare parts.

1.4.1 Ordering spare parts

This manual contains the spare parts recommended by Johnson Pump as well as the instructions for ordering them. A fax-order form is included in this manual. If you have any questions or require further information with regard to specific subjects then do not hesitate to contact Johnson Pump.

1.4.2 Pump number

The pump number is stamped on the type-plate of the pump.

For correspondence and when ordering spare parts you should always state this number and the other information on the type plate.

➤ *The pump information is also stated on the label on the front of this manual*

1.5 **Checking goods delivered**

Check the consignment immediately on arrival for damage and conformity with the advice note. In case of damage and/or missing parts, have a report drawn up by the carrier at once.

1.6 Instructions for transport and storage

1.6.1 Dimensions and weight

The CombiNorm range pump units are generally too heavy to be moved by hand. Therefore, use the correct transport and lifting equipment. Dimensions and weight of the pump (unit) are shown on the label in the front of this manual.

1.6.2 Use of pallets

In most cases the pump is packed on a pallet. In that case leave the pump on the pallet as long as possible in order to avoid damages and facilitate possible further transport in case the pump has to be moved elsewhere.

! **Use of a forklift truck: always set the forks as far apart as possible and lift the pallet using both forks.**
Avoid jolting the pump when moving it.

1.6.3 Hoisting

When hoisting a pump or complete pump units the straps must be fixed in accordance with figures 11 and 12



Never stand underneath a hoisted pump!

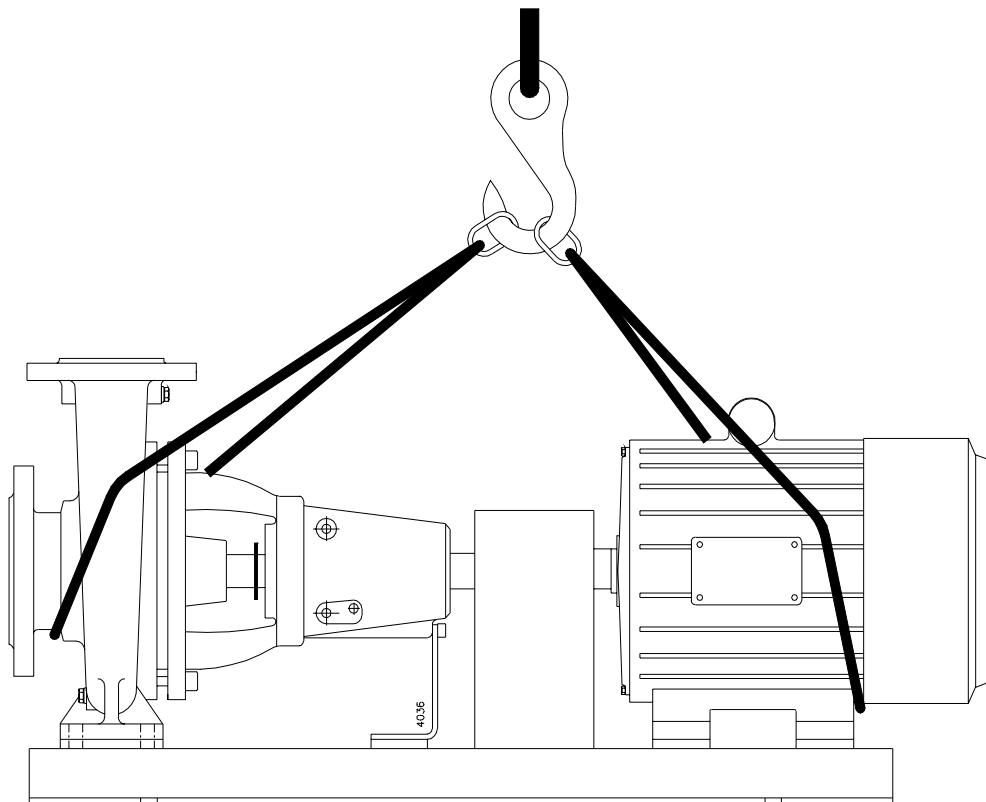


figure 11 Lifting instructions pump unit.

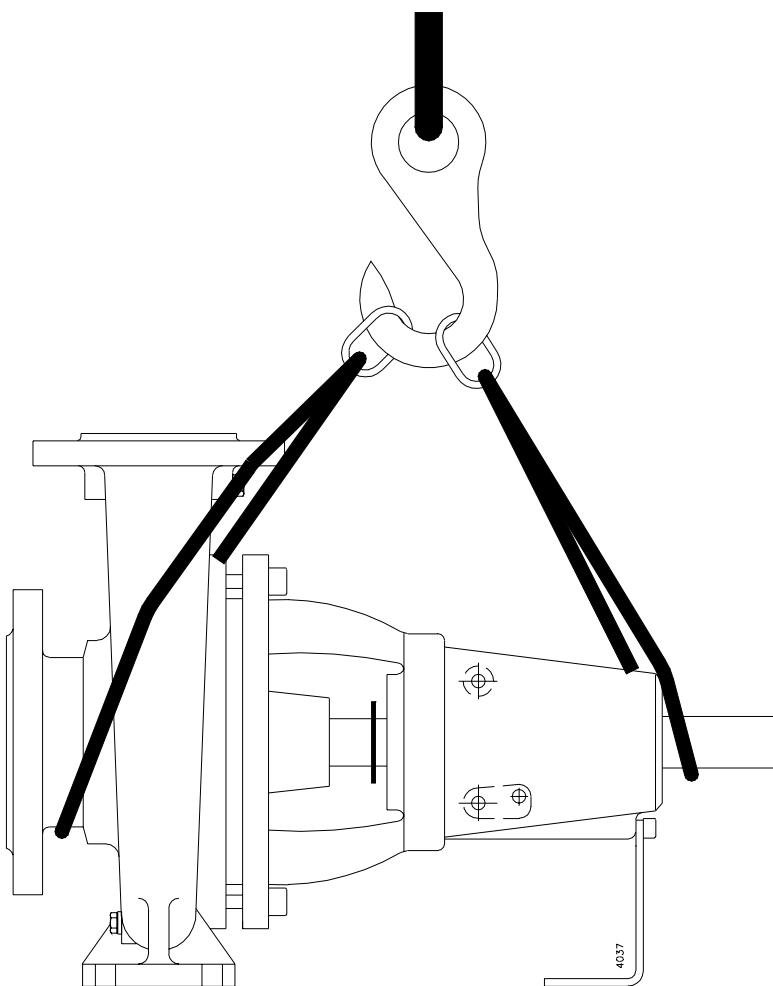


figure 12 *Lifting instructions pump.*

1.6.4 Storage

If the pump is not to be used immediately the pump shaft must be turned by hand twice per week.

2 General

2.1 Pump description

The CombiNorm is a range of horizontal non-self-priming centrifugal pumps according to EN 733 (DIN 24255). The hydraulic application area however is larger because of a extended number of available pump types.

Flange dimensions, bolt circle and number of holes comply with DIN 2533 ND 16.

The pump is driven by a standard IEC foot motor. The power is transmitted through a flexible coupling. Because of their modular lay-out, constructional components are widely interchangeable, also with other pump types of the Combi system.

2.2 Typification

Pumps of the CombiNorm family are available in various designs. The main characteristics of the pump are shown in the type code.

Example: **CN 40-200 G1 S1 L1**

pump family: **CN=CombiNorm**

pump size: **40-200**

diameter discharge connection [mm] - nominal impeller diameter [mm]

pump casing and impeller material		
G1	pump casing: cast iron	impeller: cast iron
G2	pump casing: cast iron	impeller: bronze
B2	pump casing: bronze	impeller: bronze
NG1	pump casing: nodular cast iron	impeller: cast iron
NG2	pump casing: nodular cast iron	impeller: bronze

shaft sealing	
S1	gland packing
S2	gland packing with shaft sleeve
S3	gland packing with shaft sleeve and lantern ring
S4	gland packing with shaft sleeve and cooling jacket
M1	mechanical seal, unbalanced
M2	mechanical seal, unbalanced with shaft sleeve
M3	mechanical seal, balanced with shaft sleeve
ML1	mechanical seal, unbalanced, air-cooled
ML2	mechanical seal, balanced, air-cooled

bearing	
L1	2 sealed ball bearings, grease lubricated (2RS1) (not available for bearing group 4)
L2	double-row angular contact ball-bearing (bearing group 4: 2 single angular contact ball bearings) + cylindrical bearing
L3	2 ball bearings, oil lubricated (not available for bearing group 4)
L4	double-row angular contact ball-bearing (bearing group 4: 2 single angular contact ball bearings) + cylindrical bearing, oil lubricated

2.3 Application

- In general, the CombiNorm pumps can be used for thin, clean or slightly polluted liquids. These liquids should not affect the pump materials.
- The maximum allowed system pressure and temperature and the maximum speed depend on the pump type and the pump construction. For relevant data see the tables in chapter 10.
- Further details about the application possibilities of your specific pump are mentioned in the order confirmation and/or in the data sheet enclosed with the delivery.
- Please do not use the pump for purposes other than those for which it is delivered without prior consultation with your supplier.



Using a pump in a system or under system conditions (liquid, working pressure, temperature, etc.) for which it has not been designed may hazard the user!

2.4 Construction

The CombiNorm is a range of pumps with a modular lay-out. The main components are:

- Pump casing/impeller
- Shaft sealing
- Bearing

CombiNorm pumps are available in 4 bearing bracket groups. The pumps of groups 1, 2 and 3 have only one type of pump shaft, fit to accommodate all bearing constructions (with the exception of CN 200-160, CN 300-200, CN 125-500 and CN 150-500: these pump types have a special type of pump shaft).

Furthermore, the pumps have been standardized in 10 groups with the same connection for stuffing box cover and bearing pedestal, depending on the nominal impeller diameters. The stuffing box covers are clamped between the pump casing and the bearing bracket (except for CN 125-500 and CN 150- 500).

2.4.1 Pump casing/impeller

This concerns the parts that are exposed to the pumped liquid. For each individual pump type there is only one construction of the pump casing and the impeller.

These parts can be supplied in 3 different materials or combinations thereof: cast iron, nodular cast iron and bronze. For CN 125-500 and CN 150-500 the impeller is fixed onto the pump shaft by means of 2 keys.

2.4.2 Shaft sealing

The shaft seal is available in various variants. There are 4 constructions with a stuffing box, for instance with a water-cooled cover, and there are 5 constructions with a mechanical seal, both unbalanced and balanced. Furthermore, 2 of these constructions are provided with an air-cooled cover to suit hot liquids. If the shaft is provided with a shaft sleeve, it won't get into contact with the liquid, if it is not, it will.

2.4.3 Bearing

The cast iron bearing pedestal is standard provided with 2 sealed deep-groove ball bearings. A heavier bearing is also possible. In that case the bearing construction consists of a roller bearing + a double-row angular contact ball bearing. Bearing group 4 has only one type of bearing construction, consisting of a roller bearing +2 single-row angular contact ball bearings in "O"-setup. All bearing types are available with grease or oil lubrication. The bearing pedestal of bearing group 4 consists of two parts: bearing bracket + lantern piece.

2.5 Application area

The application area globally looks as follows:

	Maximum value
Capacity	1500 m ³ /h
Discharge head	140 m
System pressure	16 bar
Temperature	160 °C

However, the maximum allowable pressures and temperatures depend strongly on the selected materials (and components).

Also working conditions may cause differences. For more detailed information see chapter 10.

2.6 Re-use

The pump may only be used for other applications after prior consultation with Johnson Pump or your supplier. Since the lastly pumped medium is not always known, the following instructions should be observed:

- flush the pump properly
- make sure the flushing liquid is discharged safely (environment!)
- Take adequate precautions and use the appropriate personal protection means (rubber gloves, spectacles)!

2.7 Scrapping

If it has been decided to scrap a pump, the same procedure as for Re-use (2.6) should be followed.

3 Installation

3.1 Safety

- Read this manual carefully prior to installation and commissioning. Non-observance of these instructions can result in serious damage to the pump and this will not be covered under the terms of our guarantee. Follow the instructions given step by step.
- Ensure that the pump can not be started if work has to be undertaken to the pump during installation and the rotating parts are insufficiently guarded.
- Depending on the design the pumps are suitable for liquids with a temperature of up to 200°C. When installing the pump unit to work at 70°C and above the user should ensure that appropriate protection measures and warnings are fitted to prevent contact with the hot pump parts.
- If there is danger of static electricity, the entire pump unit must be earthed.
- If there is a danger that the pumped liquid might be harmful to men or the environment, the user should take appropriate measures for safe drainage. Also possible leakage fluid from the shaft seal should be safely discharged.

3.2 Preservation

In order to prevent corrosion, the inside of the pump is treated with a preserving agent before leaving the factory.

Before commissioning the pump remove any preserving agents and flush the pump thoroughly with hot water.

3.3 Environment

- The foundation must be hard, level and flat.
- The area in which the pump is installed must be sufficiently ventilated. An ambient temperature or air humidity which is too high, or a dusty environment, can have a detrimental effect on the operation of the electric motor.
- There should be sufficient space around the pump unit to operate and if necessary repair it.
- Behind the cooling air inlet of the motor there must be a free area of at least 1/4 of the electric motor diameter, to ensure unobstructed air supply.

3.4 Mounting

3.4.1 Installation of the set

Pumps and motor shafts of complete sets are adjusted perfectly in line in the works. In case of permanent arrangement place the base plate on the foundation with the aid of shims and tighten the nuts on the foundation bolts carefully.

Then check the alignment of pump and motor shafts and realign, if necessary, according to the instructions in figure 13.

3.4.2 Assembly

If the pump and the electric motor still have to assembled, proceed as follows:

- 1 Mount the two coupling halves on the pump and motor shaft respectively.
- 2 Place the pump on the foundation slab. Secure the pump with bolts.
- 3 Place the electric motor on the foundation slab. Between the two coupling halves there should be a gap of 3 mm.
- 4 Place some copper shims under the feet of the electric motor. Secure the electric motor with bolts.
- 5 Align the coupling according to the following instructions.

3.4.3 Alignment of the coupling

- 1 Place a ruler (A) on the coupling. The ruler should touch both coupling halves across the whole width. See figure 13.
- 2 Do the same check against both sides of the coupling near the axis.
- 3 For all security the alignment is also checked with a pair of outside calipers (B) at 2 diametrically opposite points of the side surfaces of the coupling halves. See figure 13.

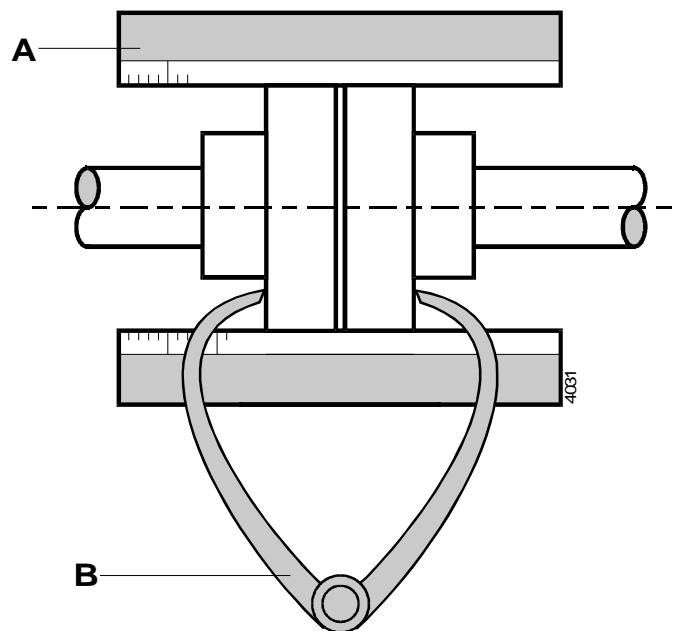


figure 13 Aligning the coupling by means of a ruler and a pair of outside calipers.

3.4.4 Tolerances for aligning the coupling

The maximum allowable tolerances in the alignment of the coupling halves are shown in the table below. See figure 14.

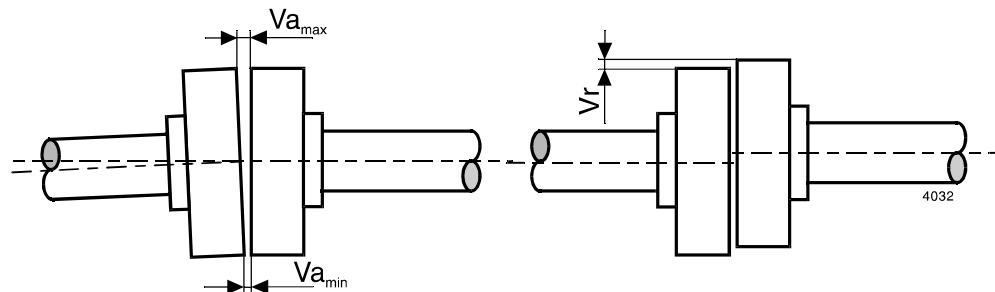


figure 14 Alignment tolerances.

External diameter of coupling [mm]	V				Va _{max} - Va _{min} [mm]	Vr _{max} [mm]
	min [mm]		max [mm]			
81-95	2	5*	4	6*	0,15	0,15
96-110	2	5*	4	6*	0,18	0,18
111-130	2	5*	4	6*	0,21	0,21
131-140	2	5*	4	6*	0,24	0,24
141-160	2	6*	6	7*	0,27	0,27
161-180	2	6*	6	7*	0,30	0,30
181-200	2	6*	6	7*	0,34	0,34
201-225	2	6*	6	7*	0,38	0,38

* = coupling with spacer

3.5 Piping

- The piping to the suction and delivery connections must fit exactly and must not be subject to stress during operation. The maximum allowable forces and moments on the pump flanges are stated in chapter 10.
- The passage of the suction pipe must be amply dimensioned. This pipe should be as short as possible and run towards the pump in such a way that no air pockets can arise. If this is not possible, a venting facility should be provided at the highest point of the pipe. If the inside diameter of the suction pipe is larger than the suction connection of the pump, an eccentric reducer should be applied to prevent air pockets and whirls. See figure 15.
- The maximum allowable system pressure is stated in chapter 10. If there is a risk that this pressure might be exceeded, for instance because of an excessive inlet pressure, appropriate measures should be taken by mounting a safety valve in the piping.
- Sudden changes in the rate of flow can lead to high pressure impulses in the pump and the piping (water shock). Therefore, don't use quick-acting closing devices, valves etc.

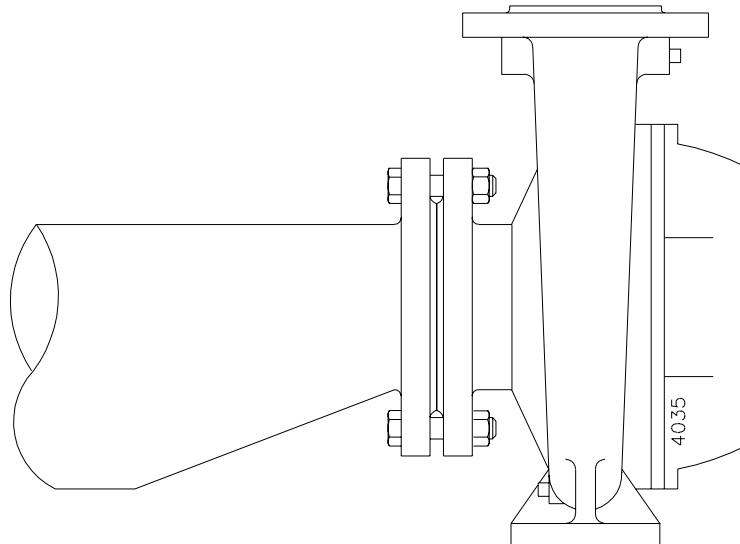


figure 15 Eccentric reducer to suction flange.

3.6 Mounting accessories

- Mount any parts that may have been supplied separately.
- If the liquid does not flow towards the pump, mount a foot valve at the bottom of the suction pipe. If necessary, combine this foot valve with a suction strainer to prevent impurities from being drawn in.
- When mounting, place temporarily (for the first 24 operating hours) a fine gauze between suction flange and suction pipe so as to prevent internal pump parts from being damaged by foreign matter. If the risk of damage continues to exist, mount a permanent filter.
- In case of a pump with a cooled stuffing box (shaft sealing variant S4), connect the cooling chamber to the cooling system.

3.7 Connection of the electric motor



The electric motor must be connected to the mains by an approved electrician, according to the locally prevailing regulations of the electricity company.

- Refer to the instruction manual belonging to the electric motor.
- If possible, mount a working switch as close as possible to the pump.

3.8 Combustion engine

3.8.1 Safety

If the pump set is designed with a combustion engine, the manual for the engine should be included in the delivery. If the manual is missing we urgently request you to contact us immediately.

Irrespective of the manual, the following points should be observed for all combustion engines:

- Comply with the local safety regulations.
- The exhaust of combustion gases must be screened off to prevent incidental contact.
- The starting device should automatically be disengaged after the engine has been started.
- The maximum speed of the engine set by us should **not** be changed.
- Before starting the engine check the oil level.

3.8.2 Sense of rotation

The sense of rotation of combustion engine and pump is indicated by means of an arrow on the combustion engine and the pump casing. Verify whether the sense of rotation of the combustion engine is the same as that of the pump.

4 Commissioning

4.1 Control pump

- Check whether the shaft turns freely. Do this by turning the shaft end at the coupling a few times by hand.
- Construction with stuffing box: check whether the gland nuts have not been over tightened. If necessary, loosen the gland nuts and retighten them by hand.

4.2 Control motor

If driven by an electric motor:

- Check whether the fuses have been mounted.

If driven by a combustion engine:

- Check whether the room in which the engine is placed is well ventilated.
- Check whether the exhaust of the engine is not obstructed.
- Before starting the engine check the oil level.
- **Never run the engine in a closed room.**

4.3 Preparation of lubrication

- The bearings of pumps provided with grease-lubricated bearings (L1, L2) are filled with grease at delivery.
- Pumps provided with oil-bath lubricated bearings (L3, L4) are supplied without oil. See chapter 10 for the specifications of the oil to be used.
 - 1 Fill the oil sump through the oil filling orifice up to the bottom of the constant level oiler.
 - 2 After that, fill the constant level oiler entirely.

4.4 Preparing the unit for commissioning

Proceed as follows, both when the unit is put into operation for the first time and after the pump has been overhauled:

- 1 Fully open the stop valve in the suction pipe. Close the delivery stop valve.
- 2 Fill the pump and the suction pipe with the liquid to be pumped.
- 3 Turn the pump shaft a few times by hand and add more liquid, if necessary.

4.5 Checking the sense of rotation



Beware of possible non-screened rotating parts, when checking the sense of rotation!

- 1 The sense of rotation of the pump is indicated by an arrow. Check whether the sense of rotation of the motor corresponds with that of the pump.
- 2 Let the motor run for only a short time and check the sense of rotation.
- 3 If the sense of rotation is **not** correct, alter the sense of rotation. See the instructions in the user manual belonging to the electric motor
- 4 Mount the protective cap.

4.6 Starting the pump

- 1 Open the stop valve in the supply piping for flushing or cooling liquid, if the pump is supplied with a flushing or cooling system.
- 2 Start the pump.
- 3 As soon as the pump is under pressure, slowly open the delivery stop valve until the working pressure is attained.



Make sure that when a pump is running, rotating parts are always properly screened off by the protective cap!

4.7 Adjustment of shaft sealing

4.7.1 Stuffing-box packing

After the pump is started, the stuffing box will show a certain amount of leakage. Because of the expansion of the packing fibres, this leakage will gradually decrease. Make sure that the packing never runs dry. To prevent this, loosen the gland nuts to the extent that the stuffing box leaks dropwise. As soon as the pump has reached the proper temperature (and leakage is still too much) the gland can be adjusted permanently:

- 1 Tighten both gland nuts, one after the other, a quarter turn.
- 2 Wait 15 minutes after each adjustment before making the next adjustment.
- 3 Continue in this way until an acceptable dropwise leakage has been attained ($10/20 \text{ cm}^3/\text{h}$)

4.7.2 Mechanical seal

A mechanical seal may never show visible leakage.

4.8 Control

If a pump is in operation pay attention to the following:

- The pump should never run dry.
- Never use a stop valve in the suction pipe to control pump capacity. The stop valve should always be fully opened during operation.
- Check whether the absolute inlet pressure is sufficient, so that no vapour can be formed.
- Check whether the pressure difference between suction and delivery pressure corresponds with the specifications for the duty point of the pump.

4.9 Noise

The noise production of a CombiNorm pump depends to a great extent on the operating conditions. The values stated in chapter 10 are based on normal operation of the pump, driven by an electric motor. In case the pump is driven by a combustion engine, or in case it is used outside the normal operation area, as well as in case of cavitation, the noise level may exceed 85 dB(A). In that case precautions should be taken, like building a noise-barrier around the unit or wearing hearing protection.

5 Maintenance

5.1 Daily maintenance

Regularly check the outlet pressure.



No water should get into the terminal box of the electric motor when the pump room is sprayed clean! Never spray water on hot pump parts! The sudden cooling down may cause them to burst and hot water may flow out!

5.2 Shaft sealing

5.2.1 Gland packing

Do not tighten the gland nuts any more after the running-in period and adjustment. If in time the gland packing starts to leak excessively, new gasket rings have to be mounted instead of further tightening the gland nuts!

5.2.2 Mechanical seal

A mechanical seal generally requires no maintenance, however, **it should never be allowed to run dry**. If there are no problems it is not advisable to dismantle the seal. As the facing surfaces are running in on one another. Dismantling always means replacement of the mechanical seal. When the shaft seal is leaking it has to be replaced.

5.3 Lubrication of the bearings

5.3.1 Grease-lubricated bearings (L1, L2)

- Bearing brackets with two grease-packed deep-groove ball-bearings (L1) require no maintenance.
- The versions with a double-row angular contact ball-bearing and a cylindrical bearing (L2) require re-greasing after every 8000 hours of operation. The bearings are filled with grease during assembly. In case the pump is overhauled, the bearing house and the bearings have to be cleaned and provided with new grease. See chapter 10 for recommended greases.

5.3.2 Oil-bath lubricated bearings (L3, L4)

- During operation the constant level oiler should never be empty, so take care to top up timely.
- The oil should be changed once a year. If the oil temperature is higher than 80°C, the oil should be changed more often. For recommended oils and quantities see chapter 10.

! **Make sure the used oil is discharged safely. See to it that it doesn't get into the environment.**

5.4 Environmental influences

- Regularly clean the filter in the suction pipe or the suction strainer at the bottom of the suction pipe, as the inlet pressure may become too low if the filter or the suction strainer is fouled.
- If there is a risk that the pumped liquid expands during solidification or freezing, the pump has to be drained and, if necessary, flushed after it has been put out of service.
- If the pump is out of service for a long time, it has to be preserved.

5.5 Noise

If, after some time, the pump starts making noise this may indicate that something is wrong with the pump unit. For instance, a crackling noise can indicate cavitation or an excessively noisy motor can indicate deterioration of the bearings.

5.6 Faults



The pump, of which you want to determine the fault, may be hot or under pressure. Take the appropriate precautions first and protect yourself with the proper safety devices (safety goggles, gloves, protective clothing)!

To determine the source of the malfunctioning of the pump, proceed as follows:

- 1 Switch off the current supply to the pump unit. Block the working switch with a lock or remove the fuse. In case of a combustion engine: switch off the engine and close the fuel supply to the engine.
- 2 Close the stop valves.
- 3 Determine the nature of the fault.
- 4 Try to determine the cause of the fault (see chapter 6) and take the appropriate measures,
or:

Contact your installer!

6 Problem solving

Faults in a pump installation can have various causes. The fault may not be in the pump, it may also be caused by the pipe system or the operating conditions. Firstly, always check that installation has been executed in accordance with the instructions in this manual and that the operating conditions still correspond with the specifications for which the pump was purchased.

In general, breakdowns in a pump installation are attributable to the following causes:

- 1 Faults with the pump.
- 2 Breakdowns or faults in the pipe system.
- 3 Faults due to incorrect installation or commissioning.
- 4 Faults due to incorrect choice of pump.

A number of the most frequently occurring failures as well as their possible causes are shown in the table below.

Most common faults	Possible causes
Pump delivers no liquid	1 2 3 4 5 6 7 8 9 10 11 13 14 17 19 20 21 29
Pump has insufficient volume flow	1 2 3 4 5 6 7 8 9 10 11 13 14 15 17 19 20 21 28 29
Pump has insufficient head	2 4 5 13 14 17 19 28 29
Pump stops after start up	1 2 3 4 5 6 7 8 9 10 11
Pump has higher power consumption than normal	12 15 16 17 18 22 23 24 25 26 27 32 34 38 39
Pump has lower power consumption than normal	13 14 15 16 17 18 20 21 28 29
The stuffing box is leaking excessively	6 7 23 25 26 30 31 32 33 43
Shaft packing or mechanical seal have to be replaced to often	6 7 23 25 26 30 32 33 34 36 41
Pump vibrates or is noisy	1 9 10 11 15 18 19 20 22 23 24 25 26 27 29 37 38 39 40
Bearings wear too much or become hot	23 24 25 26 27 37 38 39 40 42
Pump running rough, hot or seizes	23 24 25 26 27 34 37 38 39 40 42

Possible causes	
1	Pump or suction pipe not sufficiently filled or de-aerated
2	Gas or air coming from the liquid
3	Air lock in the suction pipe
4	Suction pipe leaks air
5	The pump sucks in air through the stuffing box
6	The sealing or flush water pipe to the stuffing box is not connected or blocked
7	The lantern ring in the stuffing box has been mounted wrongly
8	The manometric suction head is too high
9	Suction pipe or suction strainer is blocked
10	Insufficient immersion of foot valve or suction pipe during operation of the pump
11	NPSH available too low
12	Speed too high
13	Speed too low
14	Wrong sense of rotation
15	Pump doesn't work at the right duty point
16	Liquid density differs from the calculated liquid density
17	Liquid viscosity differs from the calculated liquid viscosity
18	Pump works when the liquid flow is too low
19	Wrong pump selection
20	Obstruction in impeller or pump housing
21	Obstruction in the piping
22	Wrong installation of the pump unit
23	Pump and motor not well aligned
24	Rotating part running out of true
25	Imbalance in rotating parts (for instance: impeller, coupling)
26	Pump shaft is running out of true
27	Bearings faulty or worn out
28	Sealing rings faulty or worn out
29	Damaged impeller
30	Pump shaft or shaft sleeve at shaft packing or running surfaces of the mechanical seal are worn out or damaged
31	Worn out or dried up shaft packing
32	Not well packed stuffing box or bad mounting of the mechanical seal
33	Packing type of the mechanical seal not suitable for the operation liquid or operation circumstances
34	Gland of seal cover has been tightened too much or crookedly
35	No water cooling of stuffing box at high temperatures
36	The sealing or flushing liquid to the stuffing box or the mechanical seal is polluted
37	Axial retaining of impeller or pump shaft is defective
38	The bearings have been mounted wrongly
39	Too much or too little bearing lubrication
40	Wrong or polluted lubricant
41	Impurities in the liquid get into the stuffing box
42	Too high axial force because of worn dorsal blades or excessive inlet pressure
43	Excessive pressure in packing space due to too much play in the throttling bush, blocked by-pass pipe or worn dorsal blades

7 Disassembly and assembly

7.1 Precautionary measures



Take adequate measures to avoid that the motor is started while you are working on the pump. This is especially important for electric motors with remote control:

- Switch the operating switch near the pump (if available) to "off".
- Switch off the pump switch on the switchboard.
- If necessary remove the fuses.
- Hang a danger board near the switchboard cabinet.

7.2 Tools

Assembly and disassembly work requires no special tools. However, such tools can make certain jobs easier, for instance replacing the shaft seal. If such is the case it will be indicated in the text.

7.3 Draining



Make sure no liquid or oil gets into the environment!

7.3.1 Liquid draining

Before starting any disassembly the pump should be drained by removing the drain plug (0310). If necessary, close the valves in the suction and delivery pipe and in the flushing or cooling pipe to the shaft seal. Take the following precautions if harmful liquids are pumped:

- Wear protective gloves, shoes, glasses, etc..
- Flush the pump properly.
- Then put the draining plug back.

7.3.2 Oil draining

- 1 If the pump is designed with oil-lubricated bearings, drain the oil by removing the drain plug (2150).
- 2 Put the drain plug back.



If possible, wear protective gloves. Regular contact with oil products may result in allergic reactions.

7.4 Construction variants

The pumps are delivered in various construction variants. Each variant has a code which is stated in the type identification on the type plate on the pump.

S1	stuffing box packing
S2	stuffing box packing with shaft sleeve
S3	stuffing box packing with shaft sleeve and lantern ring
S4	stuffing box packing with shaft sleeve and cooling jacket
M1	mechanical seal, unbalanced
M2	mechanical seal, unbalanced, shaft sleeve.
M3	mechanical seal, balanced, shaft sleeve.
ML1	mechanical seal, unbalanced, air-cooled.
ML2	mechanical seal, balanced
L1	sealed ball-bearings, grease-lubricated (2RS1)
L2	double-row (or 2 single-row in "O"-setup) angular contact ball-bearing + cylindrical bearing, grease-lubricated
L3	oil-lubricated ball-bearings
L4	double-row (or 2 single-row in "O"-setup) angular contact ball-bearing + cylindrical bearing, oil-lubricated

7.5 Back Pull Out system

CombiNorm pumps have a "Back-Pull Out" system. If the pump unit is designed with a spacer-coupling, just remove the spacer. After that the bearing bracket with the entire rotating part can be removed. This means that almost the whole pump can be dismantled without having to detach the suction and delivery piping. The motor remains in its position. If the pump unit doesn't have a spacer coupling, the motor has to be removed from the foundation before disassembly.

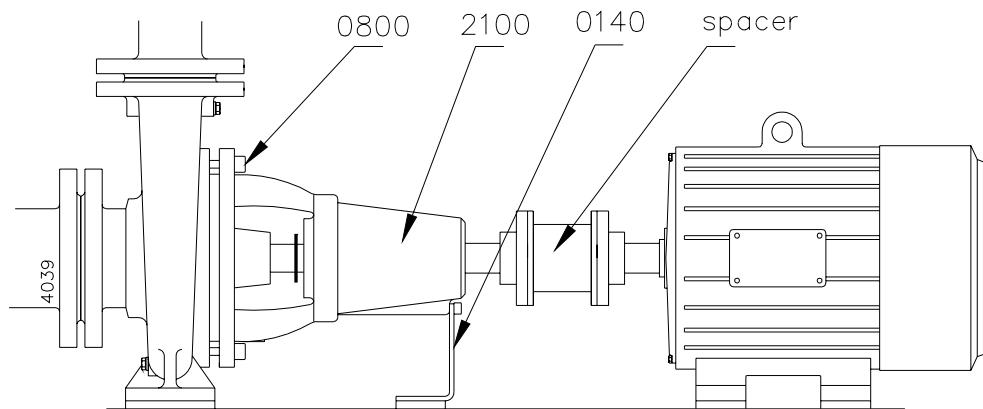


figure 16 Back Pull Out system.

7.5.1 Disassembly coupling guard

- 1 Loosen bolts (0230) and nuts (0231) and remove these including washers (0232) and (0233). See figure 19.
- 2 Remove both jackets (0270). See figure 17.
- 3 Mounted with spacer coupling: Remove the spacer. Else: Remove the electric motor.

7.5.2 Disassembly Back Pull Out unit

- 1 Disconnect possible flushing and/or cooling pipes.
- 2 Loosen the bracket support (0140) from the base plate (see figure 16).
- 3 Remove the Allen screws (0800).
- 4 Pull the entire bearing bracket (2100) from the pump casing. The entire bearing bracket of large pumps is very heavy. Support it with a beam or hang it in a pulley sling.

7.5.3 Assembly Back-Pull-Out unit

- 1 Mount a new packing for the pump casing (0300) and mount the entire bearing bracket back into the pump casing. Tighten the Allen screws (0800) crosswise.
- 2 Fix the bearing support on the foundation.
- 3 Reconnect the flushing and/or cooling pipes.
- 4 Mount the assembly plate (0275) to the bearing cover (2115) with bolts (0235). See figure 20.
- 5 Mount the coupling key (2210) and mount the coupling half onto the pump shaft.
- 6 Place the motor back in its place or mount the spacer of the spacer coupling.
- 7 Check the alignment of pump and motor shaft, see 3.4.3. If necessary, realign.

8 Mount the jacket (0270) at motor side. The annular groove must be located at motor side.

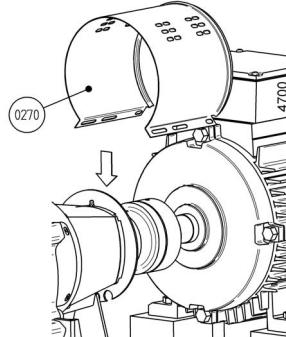


figure 17: Fitting jacket at motor side.

9 Place the assembly plate (0280) over the motor shaft and fit it into the annular groove of the jacket.

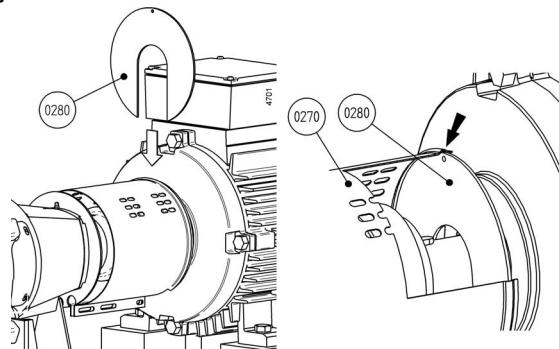


figure 18: Fitting assembly plate at motor side.

10 Close the jacket and fit a bolt (0230) and nut (0231) with washers (0232) and (0233) into the hole at motor side. See figure 19 for the proper mounting sequence.

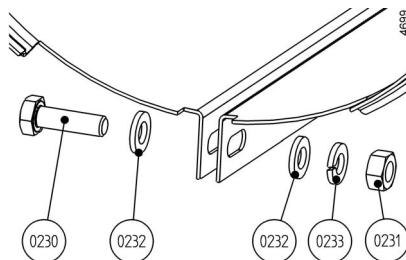


figure 19: Fitting bolt and nut with washers and spring washer.

11 Mount the jacket (0270) at pump side. Place it over the present jacket at motor side. The annular groove must be located at pump side.

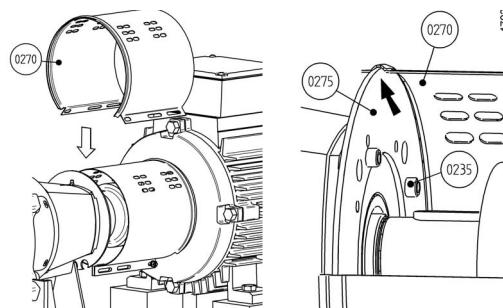


figure 20: *Fitting jacket at pump side.*

- 12 Close the jacket and fit a bolt (0230) and nut (0231) with washers (0232) and (0233) into the hole at pump side. See figure 19 for the proper mounting sequence.
- 13 Slide the jacket at motor side towards the motor as far as possible. Fix both jackets with bolt (0230) and nut (0231) with washers (0232) and (0233) fitted into the overlapping slot holes.

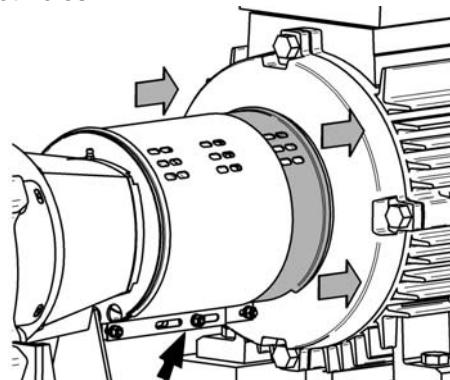


figure 21: *Adjusting jacket at motor side.*

7.6 Replacement of impeller and casing wear ring

The play between the impeller and the casing wear ring is 0,3 mm to the diameter at delivery. In case the play has increased to 0,5-0,7 mm due to wearing, the impeller and the casing wear ring should be replaced.

7.6.1 Disassembly of the impeller, S1 - M1 - ML1

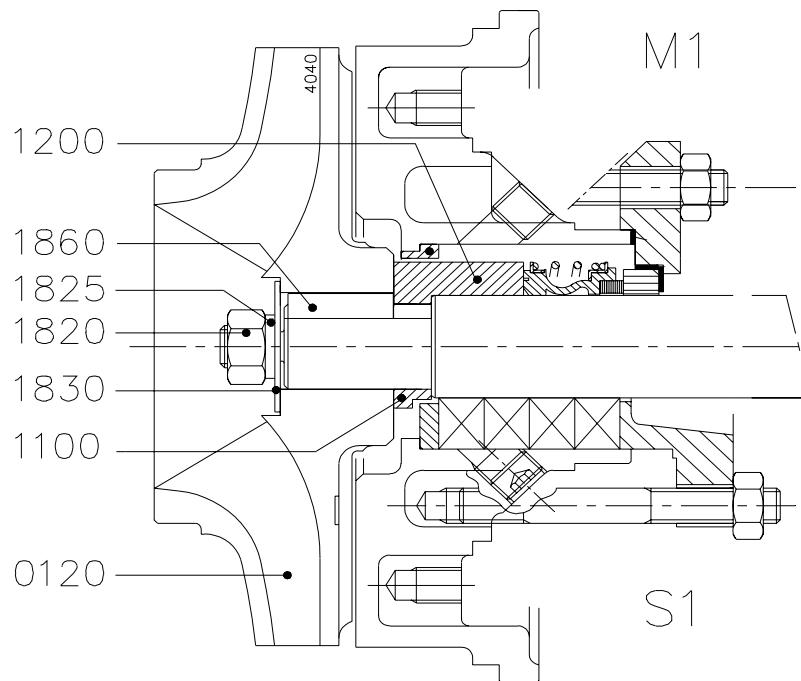


figure 22 Impeller S1 - M1 - ML1.

The item numbers used are referring to figure 22

- 1 Disassemble the Back Pull Out unit, see 7.5.2.
- 2 Remove the impeller nut (1820), spring washer (1825) and the washer (1830). **Sometimes the nut has to be heated to break the Loctite-contact.**
- 3 Remove the impeller (0120) with a pulley puller (or wrest the impeller free by inserting for instance 2 big screwdrivers between the impeller and the stuffing box cover (0110)).
- 4 Remove the impeller key (1860).

7.6.2 Assembly of the impeller, S1 - M1 - ML1

- 1 Place the impeller key in the key way of the pump shaft.
- 2 Push the impeller onto the pump shaft against the distance sleeve (1100) for the shaft sealing arrangement S1, or against the shaft sleeve (1200) for the shaft sealing arrangement M1.
- 3 Degrease the pump shaft thread and the thread in the impeller nut.
- 4 Put a drop of Loctite 243 on the thread and mount the impeller nut with washer and spring washer.

For tightening moment of the nut see chapter 10.

7.6.3 Disassembly of the impeller, S2 - S3 - M2 - M3 - ML2

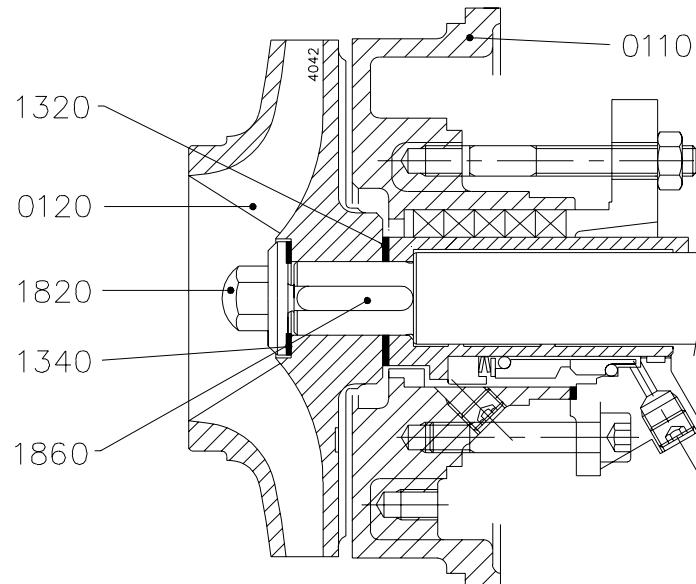


figure 23 Impeller S2 - S3 - M2 - M3 - ML2.

The item numbers used are referring to figure 23.

- 1 Disassemble the back Pull Out unit, see 7.5.2.
- 2 Remove the cap nut (1820) and the gasket (1340). Sometimes the nut has to be heated to break the Loctite-contact.
- 3 Remove the impeller (0120) with a pulley puller (or wrest the impeller by inserting for instance 2 big screwdrivers between the impeller and the stuffing box cover (0110)).
- 4 Remove the gasket (1320).
- 5 Remove the impeller key (1860) (CN125-500 + CN150-500: impeller keys (1860 + 1865)).

7.6.4 Mounting the impeller, S2 - S3 - M2 - M3 - ML2

- 1 Mount the gasket (1320).
- 2 Place the impeller key (1860) (CN125-500 + CN150-500: impeller keys (1860 + 1865)) in the key way(s) of the pump shaft.
- 3 Push the impeller onto the pump shaft until it touches the gasket (1320).
- 4 Degrease the thread on the pump shaft and the thread in the cap nut.
- 5 Put a drop of Loctite 243 on the thread and mount the cap nut and gasket. For tightening moment of the nut see table in chapter 10.

7.6.5 Disassembly of the casing wear ring

After removing the Back Pull Out unit (see 7.5.1) the casing wear ring can be removed (CN 32-250 and bearing groups 2, 3 and 4). In most cases the ring has been fixed so tightly that it cannot be removed undamaged.

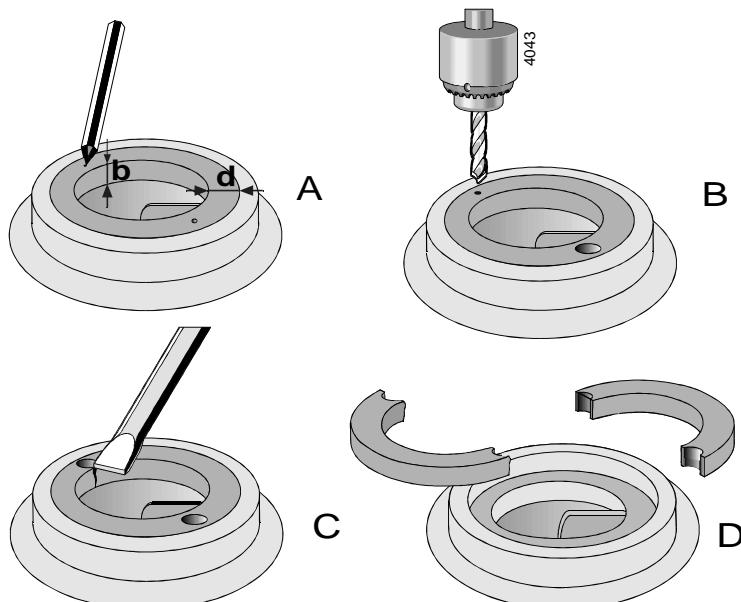


figure 24 Disassembly of the casing wear ring.

- 1 Measure the thickness (D) and the width (B) of the ring (see figure 24 A).
- 2 Make a centre hole in the middle of the edge of the ring at two opposite points (See figure 24 B).
- 3 Use a drill with a diameter just a little bit smaller than the thickness (D) of the ring and drill two holes in the ring (see figure 24 C). Don't drill deeper than the width (B) of the ring. Take care not to damage the fitting edge of the pump casing.
- 4 Use a chisel to cut the remaining part of the ring thickness. Now you can remove the ring in two parts from the pump casing (see figure 24 D).
- 5 Clean the pump casing and carefully remove all bore dust and metal splinters.

7.6.6 Assembly of the casing wear ring

- 1 Clean and degrease the fitting edge of the pump casing where the casing wear ring is to be mounted.
- 2 Degrease the outer edge of the casing wear ring and put a few drops of Loctite 641 (ML1 and ML2 Loctite 648) on it.
- 3 Mount the casing wear ring in the pump casing. **Take care it is not pushed out of alignment!**

7.7 Replacement of the stuffing box packing

7.7.1 Instruction for assembling and disassembling stuffing box packing

➤ *First read the following instructions regarding stuffing box packing. Follow these instructions closely when removing and mounting stuffing box packing.*

- For removing old packing your supplier can supply a special packing puller. See figure 25.

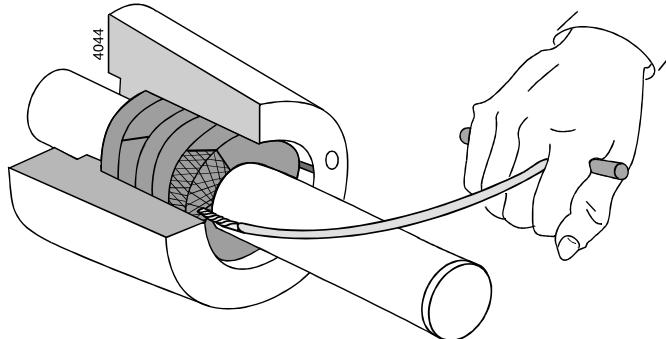


figure 25 A special packing puller.

- Only use a packing with the right dimensions.
- Grease the stuffing box, the shaft sleeve and the packing rings with some graphite grease or silicon grease, see chapter 10 for the allowed grease types.
- Bend the packing rings open axially, as shown in figure 26.

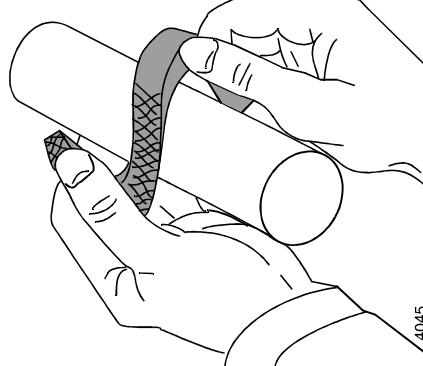


figure 26 Bending the packing rings open axially

- For pressing the packing down, use a halve piece of tube with the right dimensions.

7.7.2 Replacement of the stuffing box packing S1, S2, S3 and S4

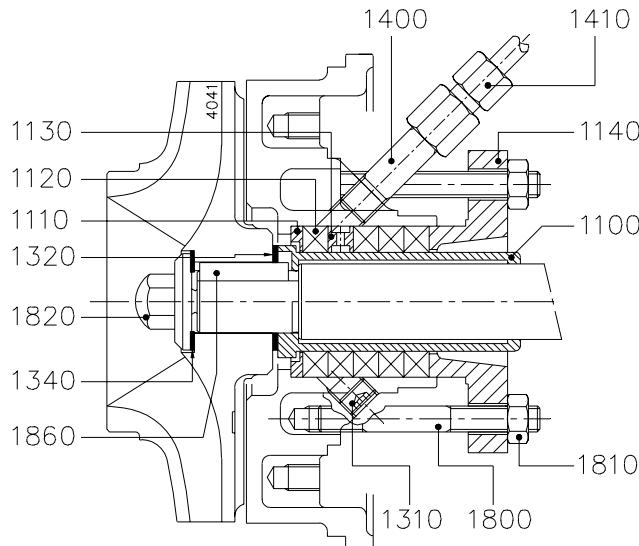


figure 27 Stuffing box packing S1, S2, S3 and S4.

To replace the stuffing box packing it is not necessary to disassemble the pump. The pump should however be drained, see 7.3.

The item numbers used are referring to figure 27.

- 1 Loosen the gland nuts (1810) and push the gland (1140) (CN125-500 + CN150-500: gland (1140) and gland cap (1145)) backward as far as possible.
- 2 Remove the old packing (1120) and a possible lantern ring (1130).
- 3 Clean the packing space properly.
- 4 Check whether the pump shaft (2200), or the shaft sleeve (1100) is damaged. If so, you still have to disassemble the pump. For disassembly of the shaft sleeve and the pump shaft see 7.7.4 and 7.9 respectively.

7.7.3 Mounting a new stuffing box packing S1, S2, S3 and S4

- 1 Bend the first packing ring open. Put it around the pump shaft (2200) resp. the shaft sleeve (1100) and press it strongly against the bottom ring (1110) at the bottom of the stuffing box.
- 2 If necessary mount the lantern ring.
- 3 Mount the subsequent rings one by one. Press them down properly. Make sure that the cuts of the rings are positioned 90° turned in relation to each other.
- 4 Press the gland (CN125-500 + CN150-500: gland and gland cap) against the last ring and tighten the gland nuts crosswise by hand.
- 5 See 4.7.1 for correct adjustment of the gland.

7.7.4 Disassembly of the shaft sleeve S2, S3, S4

- 1 Disassemble the impeller, see 7.6.
- 2 Pull the shaft sleeve (1100) from the pump shaft.

7.7.5 Mounting the shaft sleeve S2, S3, S4

- 1 Slide the shaft sleeve over the pump shaft. Watch the position of the key ways in the shaft sleeve in respect of those in the pump shaft.
- 2 **For pump typesd CN 200-160 and CN 300-200 the shaft sleeve must be adjusted according to distance Y, see figure 28**
- 3 Mount the impeller and the other parts, see 7.6 and 7.7.3.

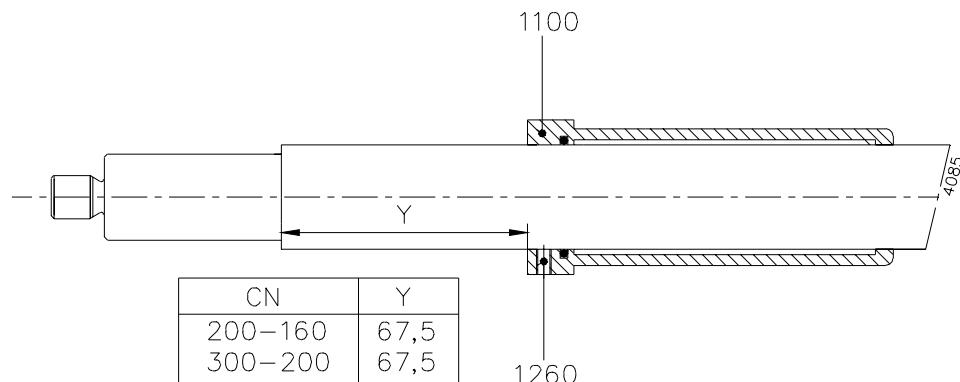


Figura 28 Adjusting shaft sleeve of CN 200-160 and CN 300-200

7.8 Mechanical seal

7.8.1 Instructions for mounting a mechanical seal

➤ First read the following instructions regarding the mounting of a mechanical seal. Follow these instructions closely when mounting a mechanical seal.

- **Leave the assembly of a mechanical seal with PTFE (Teflon) covered O-rings to a specialist.** These rings are easily damaged during assembly.
- A mechanical seal is a fragile precision instrument. Leave the seal in its original packing until you are ready to mount it!
- Clean all receiving parts properly. Make sure your hands and working environment are clean!
- **Never touch the sliding surfaces with ones fingers!**
- Take care not to damage the seal during assembly. Never put the rings down on their sliding surfaces!

7.8.2 Disassembly of the mechanical seal M1

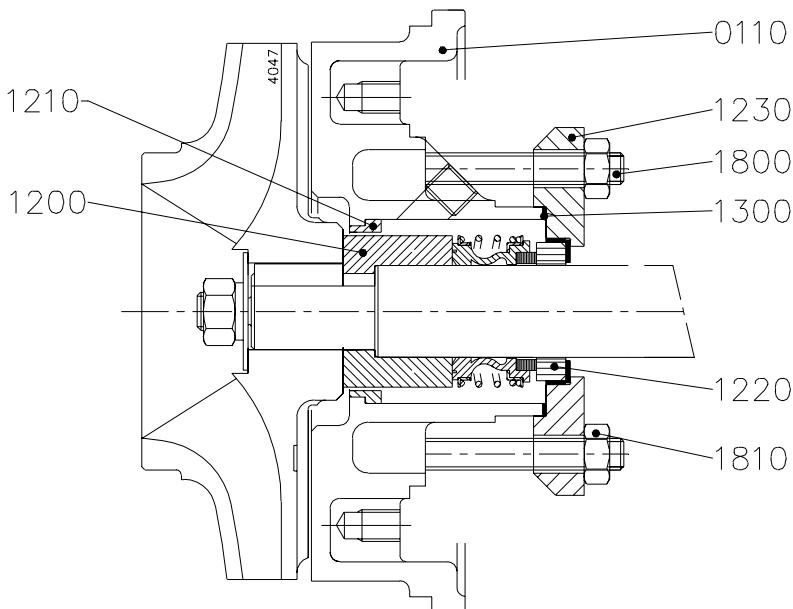


figure 29 Mechanical seal M1.

The item numbers used are referring to figure 29.

- 1 Disassemble the impeller, see 7.6.
- 2 Remove the nuts (1810) and push the cover of the mechanical seal (1230) backward.
- 3 Mark the position of the stuffing box cover (0110) in relation to the bearing bracket (2100). Knock the stuffing box cover loose and remove it.
- 4 Push the shaft sleeve (1200) and the rotating part of the shaft seal (1220) off the shaft. **For pump types CN 200-160 and CN 300-200 the tightening screws (1260) have to be loosened first.** See figure 31.
- 5 Push the mechanical seal cover off the pump shaft and push the counter-ring out of it.

7.8.3 Assembly of the mechanical seal M1

➤ *Special tools: Assembly of the mechanical seal is easier with a special conical mounting bush. The mounting bush covers the sharp edges on the shaft, so the risk of damaging the seal during assembly is reduced. See figure 30.*

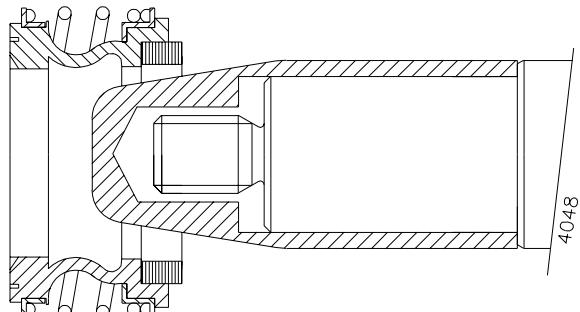


figure 30 Special conical mounting bush.

- 1 Make sure the shaft sleeve (1200), the smothering bush (1210) and the splash ring (2220) are not damaged. The splash ring should also clasp the shaft very

well. If necessary, replace these parts. Secure the smothering bush with Loctite 641.

- 2 Put the mechanical seal cover flat down and press the counter-ring straight into it. If necessary, use a plastic pressure piece. **Never hammer it inside!** The maximum axial turn of the counter-ring is 0,1 mm.
- 3 Place the bearing bracket with the shaft upright and place a new gasket (1300).
- 4 Push the cover of the mechanical seal onto the pump shaft.
- 5 Push the rotating part of the mechanical seal over the pump shaft. The bellows should slide smoothly over the shaft. Put some glycerine or silicon spray on it.
- 6 Mount the stuffing box cover in the right position in the fitting edge of the bearing bracket. Make sure that the stuffing box cover is at right angles to the pump shaft.
- 7 Mount the cover of the mechanical seal (1230) against the stuffing box cover. Watch the position in view of the connecting points. Tighten the nuts (1810) crosswise. **The cover should not be oblique!**
- 8 Mount the shaft sleeve (1200). For pump types CN 200-160 and CN 300-200 the shaft sleeve (1200) has to be adjusted according to distance Y, see figure 31.
- 9 Mount the impeller and other parts, see 7.6.

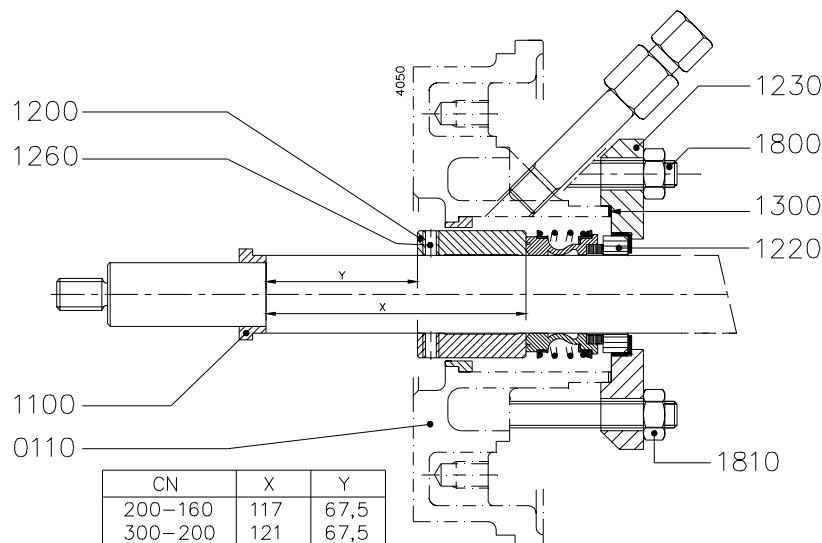


figure 31 Adjusting the shaft sleeve of CN 200-160 and CN 300-200.

7.8.4 Disassembly of the mechanical seal M2-M3

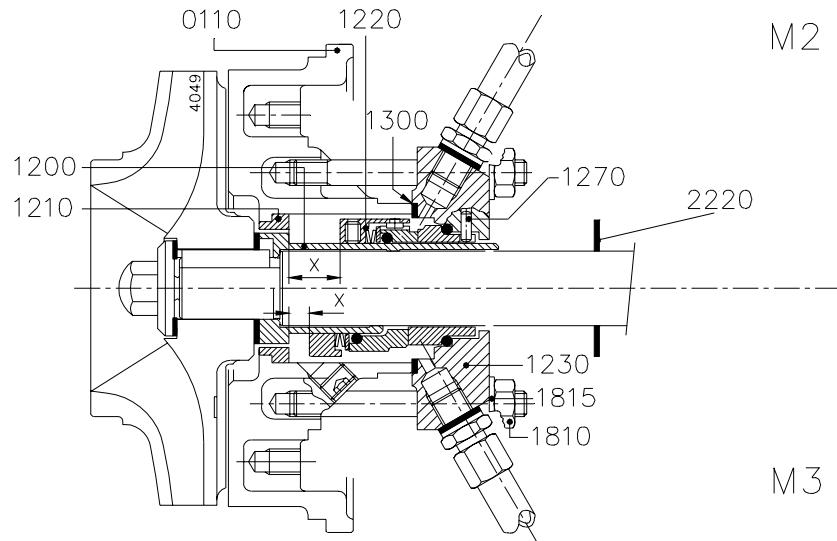


figure 32 Mechanical seal M2-M3.

The item numbers used are referring to figure 32.

- 1 Remove the impeller, see 7.6.
- 2 Remove the nuts (1810) and the washer (1815) and push the mechanical seal cover (1230) backward.
- 3 Mark the position of the stuffing box cover (0110) in relation to the bearing bracket (2100). Knock the stuffing box cover loose and remove it.
- 4 Pull the shaft sleeve (1200) from the pump shaft and remove the rotating part of the mechanical seal from the shaft sleeve. For pumptypes CN 200-160 and CN 300-200 the tightening screws (1260) have to be loosened first! (See figure 20)
- 5 Push the cover of the mechanical seal off the pump shaft and push the counter-ring out of the cover.

7.8.5 Assembly of the mechanical seal M2-M3

- 1 Make sure the shaft sleeve (1200), the smothering bush (1210) and the splash ring (2220) are not damaged. The splash ring should also clasp the shaft properly. If necessary, replace these parts. Secure the smothering bush with Loctite 641.
- 2 Put the mechanical seal cover flat down and press the counter-ring of the seal straight into it. The notch in the counter ring must correspond to the locking pin (1270), else the counter ring will break! If necessary, use a plastic pressure piece. **Never hammer it inside!** The maximum axial turn of the counter-ring is 0,1 mm.
- 3 Place the bearing bracket with the shaft upright and place a new gasket (1300).
- 4 Push the cover of the mechanical seal onto the pump shaft.
- 5 Push the rotating part of the seal onto the shaft sleeve. **Put some glycerine or silicon spray on the O-ring to prevent it from rolling on the shaft sleeve.**
- 6 Fix the rotating part of the seal on the shaft sleeve according to dimension X in the table below. See also figure 32.

M2		M3	
shaft sleeve diameter	X	shaft diameter	X
35	22,5	30	15
45	30	40	22,5
55	37,5	50	27,5
80	17,5	75	7,5

- 7 Push the shaft sleeve (1200) onto the pump shaft. For pump types CN 200-160 and CN 300-200 the shaft sleeve (1200) has to be adjusted according to distance Y, see figure 31!
- 8 Mount the stuffing box cover in the right position in the fitting edge of the bearing bracket. Check whether the stuffingbox cover is at right angles to the pump shaft.
- 9 Mount the cover of the mechanical seal (1230) against the stuffing box cover. Check the position in view of the connection points. Tighten the nuts (1810) crosswise. The cover should not be oblique!
- 10 Mount the impeller and other parts, see 7.6.

7.8.6 Disassembly of the mechanical seal ML1 - ML2

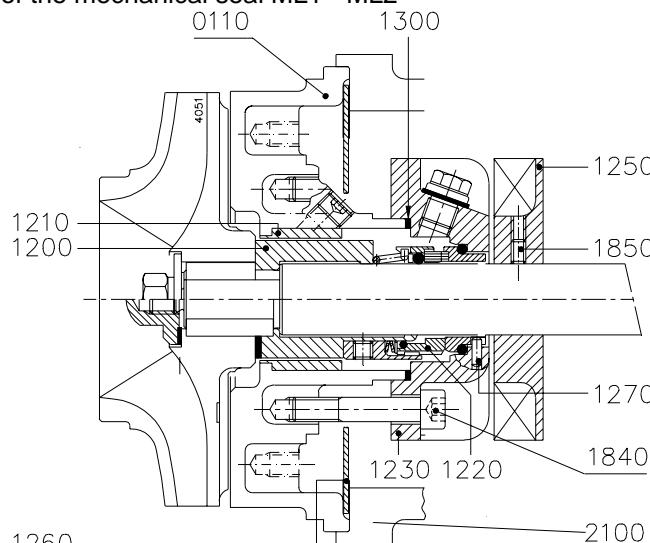


figure 33 Mechanical seal ML1-ML2.

The item numbers used are referring to figure 33.

- 1 Remove the impeller. See 7.6.
- 2 Loosen the locking screws (1850) and push the fan (1250) towards the bearing.
- 3 Remove the allen screws (1840) and push the cover of the mechanical seal (1230) backward.
- 4 Mark the position of the stuffing box cover (0110) in relation to the bearing bracket (2100). Knock the stuffing box cover loose and remove it.
- 5 Pull the shaft sleeve (1200) from the pump shaft.
- 6 Push the rotating part of the seal from the shaft.
- 7 For the shaft seal group ML2, the rotating part of the shaft seal stuck to the shaft sleeve. Loosen the set screws and slide the rotating part off the shaft sleeve.
- 8 Push the cover of the mechanical seal (1230) off the pump shaft and push the counter-ring out of the cover.

7.8.7 Assembly of the mechanical seal ML1 - ML2

➤ *Special tools: the seal groups M1 and ML1 are easily mounted by using a special conical mounting bush. The mounting bush covers the sharp edges on the shaft, which means that the risk of damaging the seal during assembly is reduced. See also figure 30.*

- 1 Make sure the shaft sleeve (1200), the smothering bush (1210) and the splash ring (2220) are not damaged. The splash ring should also clasp the shaft properly. If necessary, replace these parts. Secure the smothering bush with Loctite 648 'Heat resistant retainer'.
- 2 Put the cover of the mechanical seal flat down and press the counter-ring of the seal straight into it. The notch in the counter ring must correspond to the locking pin (1270), else the counter ring will break! If necessary, use a plastic pressure piece. **Never hammer it inside!** The maximum axial turn of the counter-ring is 0.1 mm.
- 3 Place the bearing bracket with the shaft upright and place a new gasket (1300).
- 4 Push the cover of the mechanical seal onto the pump shaft.
- 5 Push the rotating part of the seal onto the pump shaft or shaft sleeve. **Put some glycerine or silicon spray on the O-ring to prevent it from rolling on the shaft sleeve.**
- 6 Push the shaft sleeve onto the pump shaft. Verify the position of the shaft sleeve in view of the key ways in the pump shaft and the shaft sleeve.
- 7 Mount the stuffing box cover in the correct position in the fitting edge of the bearing bracket.
- 8 Check whether the stuffing box cover is at right angles to the pump shaft.
- 9 Mount the cover of the mechanical seal (1230) against the stuffing box cover. Check the position in view of the connection points. Tighten the allen screws (1840) crosswise. **The cover should not be oblique!**
- 10 Push the fan (1250) in position and tighten the locking screws (1850). **The fan should not run out of true.**
- 11 Mount the impeller and other parts. See 7.6

7.9 Bearing

7.9.1 Instructions for assembly and disassembly of bearings

➤ *First read the following instructions regarding assembly and disassembly.*

Follow these instructions closely when assembling and disassembling bearings.

Disassembly:

- Use a proper puller to remove the bearings from the pump shaft.
- If no proper puller is available, carefully knock the inner raceway of the bearing. Use a normal hammer and a soft-metal drift. **Never knock the bearing with a hammer!**

Assembly:

- Make sure your workplace is clean and leave the bearings in their original packaging as long as possible.
- Make sure the shaft and the bearing seats do have a smooth surface, free of burrs.
- Slightly oil the shaft and the other relevant parts before assembly.
- Preheat the bearings to 110°C before mounting them on the pump shaft.

- If preheating is not possible, then knock the bearing onto the shaft. **Never knock the bearing directly:** Use a mounting bush positioned against the inner raceway of the bearing and a normal hammer (a soft hammer might loose some splinters which could damage the bearing).

7.9.2 Disassembly of bearing L1 (standard, grease-lubricated)

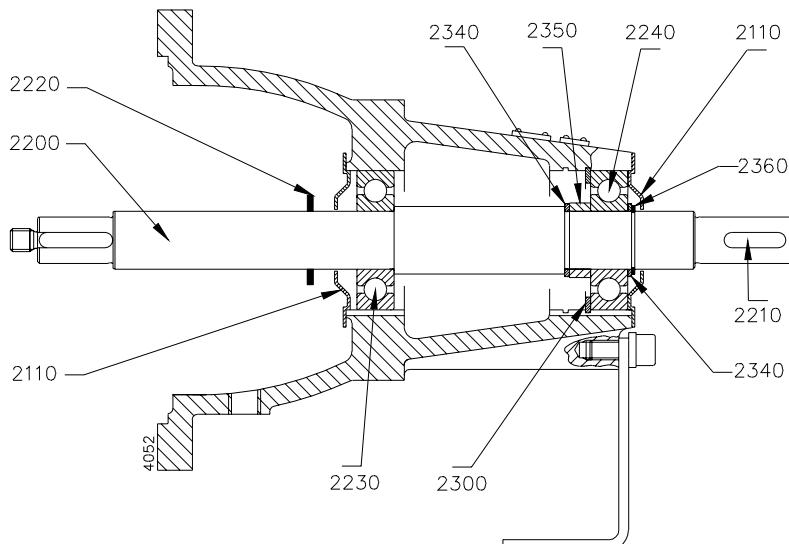


figure 34 Bearing L1 (standard, grease-lubricated).

The item numbers used are referring to figure 34.

- 1 Disassemble the impeller and shaft seal. See 7.6 and 7.8.
- 2 Remove the splash ring (2220) and the bearing covers (2110).
- 3 Knock the pump shaft (2200) on the impeller side so as to loosen the bearings from the bearing bracket. Use a plastic hammer to avoid damage to the thread.
- 4 Remove the inner circlip (2300) as soon as the first bearing (2240) is out of the bearing bracket. Subsequently remove the pump shaft with the bearings from the bearing bracket.
- 5 Disassemble the coupling with a coupling puller and remove the coupling key (2210).
- 6 Remove the outer circlip (2360) and adjustment ring (2340).
- 7 Remove the distance sleeve (2350) and adjustment ring (2340).

7.9.3 Assembly of bearing L1

- 1 Clean the interior of the bearing bracket properly.
- 2 Mount the adjustment ring (2340), the inner circlip (2300) and the distance sleeve (2350) on the pump shaft.
- 3 Preheat the bearings and mount them on the pump shaft. Make sure they are positioned straight on the shaft and push them firmly against the shaft shoulder and against the distance sleeve (2350). **Let the bearings cool down!**
- 4 Mount the adjustment ring (2340) and mount the outer circlip (2360).
- 5 Mount the shaft with bearings, starting from the motor side, in the bearing bracket. Knock the shaft end on the coupling side until the first bearing (2230) slides through the bearing boring. After each knock rotate the shaft one turn to prevent bearing damage.
- 6 Mount the inner circlip (2300) **in the first groove.**

- 7 Carefully knock the shaft further into the bearing bracket until the outer ring of the bearing (2240) touches the inner circlip (2300). The shaft with the bearings should go into the bearing bracket **straight!**
- 8 Mount the bearing covers (2110) and the splash ring (2220).
- 9 Mount the shaft seal and the impeller as described in 7.6 and 7.8.
- 10 Mount the coupling.

7.9.4 Disassembly of bearing L3 (standard, oil-lubricated)

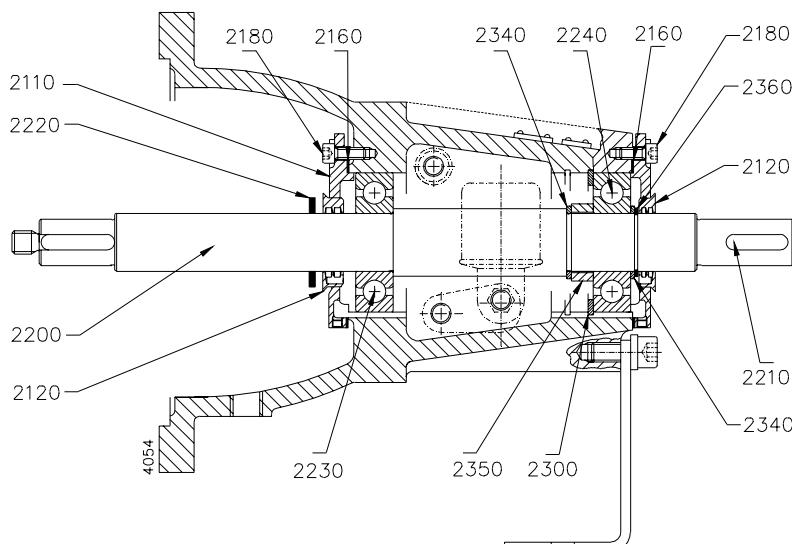


figure 35 Bearing L3 (standard, oil-lubricated).

The item numbers used are referring to figure 35.

- 1 Disassemble the impeller and shaft seal. See 7.6 and 7.8.
- 2 Remove the splash ring (2220). Loosen the screws (2810) and remove the gaskets (2160) and the bearing covers (2110).
- 3 Knock the pump shaft (2200) on the impeller side so as to loosen the bearings from the bearing bracket. Use a plastic hammer to avoid damage to the thread.
- 4 Remove the inner circlip (2300) as soon as the first bearing (2240) is out of the bearing bracket. Subsequently remove the pump shaft with the bearings from the bearing bracket.
- 5 Disassemble the coupling with a coupling puller and remove the coupling key (2210).
- 6 Remove the outer circlip (2360) and the adjustment ring (2340) and remove the bearings from the pump shaft.
- 7 Remove the distance sleeve (2350) and adjustment ring (2340).
- 8 Check whether the oil catchers (2120 and 2125) are not damaged. If necessary, replace them.

7.9.5 Assembly of bearing L3

- 1 Clean the interior of the bearing bracket properly.
- 2 Mount the inner circlip (2300), the adjustment ring (2340) and the distance sleeve (2350) on the pump shaft.
- 3 Preheat the bearings and mount them on the pump shaft. Make sure they are positioned straight on the shaft and push them firmly against the shaft shoulder and against the distance sleeve (2350). **Let the bearings cool down!**
- 4 Mount the adjustment ring (2340) and mount the outer circlip (2360).

- 5 Mount the shaft with bearings, starting from the motor side, in the bearing bracket. Knock the shaft end on the coupling side until the first bearing (2230) slides through the bearing boring. After each knock rotate the shaft one turn to prevent bearing damage.
- 6 Mount the inner circlip (2300) **in the first groove!**
- 7 Carefully knock the shaft further into the bearing bracket until the outer ring of the bearing (2240) touches the inner circlip (2300). The shaft with the bearings should go into the bearing bracket **straight!**
- 8 Mount the bearing covers (2110) with the gaskets (2160). Place the splash ring around the pump shaft (2220).
- 9 Mount the shaft seal and the impeller as described in 7.7 7.6 and 7.8.
- 10 Mount the coupling.

7.9.6 Disassembly of bearing L2 (reinforced, grease-lubricated)

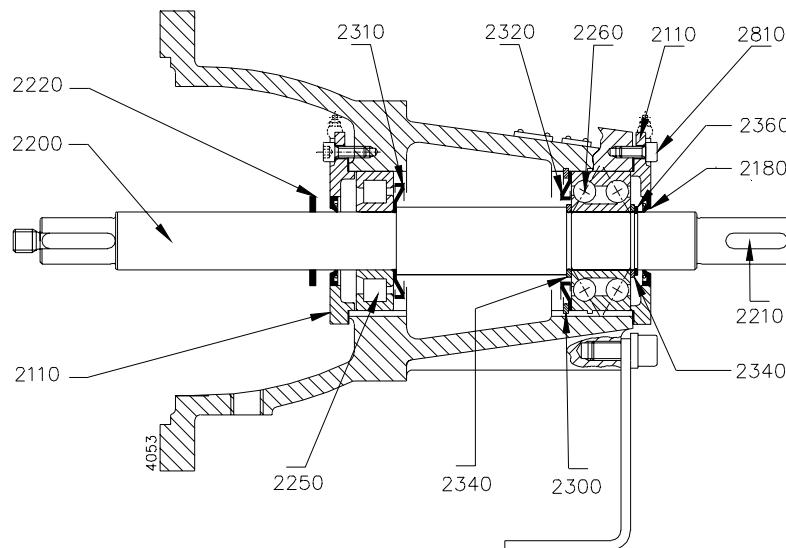


figure 36 Bearing L2 (reinforced, grease-lubricated).

The item numbers used are referring to figure 36.

- 1 Disassemble impeller and shaft seal. See 7.6 and 7.8.
- 2 Remove the splash ring (2220). Loosen the screws (2810) and remove the bearing covers (2110 and 2115).
- 3 Knock the pump shaft (2200) on the impeller side so as to loosen the bearings from the bearing bracket. Use a plastic hammer to avoid damage to the thread.
- 4 Remove the inner circlip (2300) as soon as the first bearing (2240) is out of the bearing bracket. Subsequently remove the pump shaft with the bearings from the bearing bracket.
- 5 Disassemble the coupling with a coupling puller and remove the coupling key (2210).
- 6 Remove the outer circlip (2360) and the adjustment ring (2340) and remove the bearings from the pump shaft. Bearing group 4: Knock the lip of the retaining ring (2570) out of the shaft nut (2560). Loosen the shaft nut and remove the bearings from the pump shaft.
- 7 Remove the adjustment ring (2340) (not for bearing group 4) and the Nilos-rings (2320 and 2310).

7.9.7 Assembly of bearing L2

- 1 Clean the interior of the bearing bracket properly.
- 2 Mount the inner circlip (2300) and the two Nilos rings (2310) and (2320) on the pumpshaft. **Make sure the Nilosrings are positioned properly!**
- 3 Mount an adjustment ring (2340) on the pump shaft (not for bearing group 4).
- 4 Preheat the double-row angular contact ball bearing (bearing group 4: the 2 single-row angular contact ball bearings) and the inner ring of the roller bearing and mount them on the pump shaft. **Watch the mounting sequence: Mount the angular contact ball bearings on the drive side!** The 2 single-row angular contact ball bearings are to be mounted in "O"-setup! Make sure they are positioned straight on the pump shaft and press them firmly against the shaft shoulder and against the adjustment ring (2340). **Let the bearings cool down!**
- 5 Mount the other adjustment ring (2340) and mount the outer circlip (2360). Bearing group 4: Mount the retaining ring (2570) and put the shaft nut (2560) on the pump shaft. Tighten the shaft nut and secure it by knocking a lip of the retaining ring into the opening of the shaft nut.
- 6 Mount the shaft with bearings, starting from the motor side, in the bearing bracket. Make sure the Nilos ring (2320) is placed before the inner circlip and mount the inner circlip (2300) **in the second groove**.
- 7 Carefully knock the shaft further into the bearing bracket until the outer ring (2260) of the bearing touches the inner circlip (2300). The Nilos ring (2320) is now locked between the bearing and the inner circlip.
- 8 Mount the outer ring of the roller bearing. This ring should go into the bearing bracket **straight**.
- 9 Mount the bearing covers (2110) and the splash ring (2220).
- 10 Mount the shaft seal and the impeller as described in 7.6 and 7.8.
- 11 Mount the coupling.

7.9.8 Disassembly of bearing L4 (reinforced, oil lubricated)

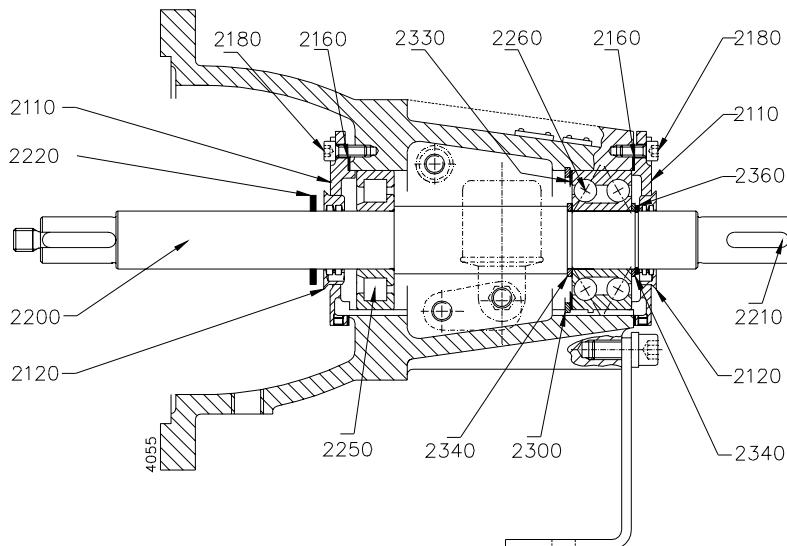


figure 37 Bearing L4 (reinforced, oil lubricated).

The item numbers used are referring to figuur 37.

- 1 Disassemble the impeller and shaft seal. See 7.6 and 7.8.
- 2 Remove the splash ring (2220). Loosen the screws (2810) and remove the bearing covers (2110) and gaskets (2160).
- 3 Knock the pump shaft (2200) on the impeller side so as to loosen the bearings from the bearing bracket. Use a plastic hammer to avoid damage to the thread. Remove the inner circlip (2300) as soon as the first bearing (2240) is out of the bearing bracket. Subsequently remove the pump shaft with the bearings from the bearing bracket.
- 4 Disassemble the coupling with a coupling puller and remove the coupling key (2210).
- 5 Remove the outer circlip (2360) and the adjustment ring (2340) and remove the bearings from the pump shaft. Bearing group 4: Knock the lip of the retaining ring (2570) out of the shaft nut (2560). Loosen the shaft nut and remove the bearings from the pump shaft.
- 6 Remove adjustment ring (2340) and adjustment ring (2330) (not for bearing group 4).
- 7 Check whether the oil catchers (2120 and 2125) are not damaged. If necessary, replace them.

7.9.9 Assembly of bearing L4

- 1 Clean the interior of the bearing bracket properly.
- 2 Mount inner circlip (2300), adjustment ring (2330) and one of the adjustment rings (2340) on the pump shaft.
- 3 Preheat the double-row angular contact ball bearing (bearing group 4: the 2 single-row angular contact ball bearings) and the inner ring of the roller bearing and mount them on the pump shaft. **Watch the mounting sequence: Mount the angular contact ball bearings on the drive side!** The 2 single-row angular contact ball bearings are to be mounted in "O"-setup! Make sure they are positioned straight on the pump shaft and press them firmly against the shaft shoulder and against the adjustment ring (2340). **Let the bearings cool down!**
- 4 Mount the other adjustment ring (2340) and outer circlip (2360). Bearing group 4: Mount the retaining ring (2570) and put the shaft nut (2560) on the pump shaft. Tighten the shaft nut and secure it by knocking a lip of the retaining ring into the opening of the shaft nut.
- 5 Mount the shaft with bearings, starting from the motor side, in the bearing bracket. Make sure the Nilos ring (2320) is placed before the inner circlip and mount the inner circlip (2300) **in the second groove**.
- 6 Carefully knock the shaft further into the bearing bracket until the outer ring of the bearing (2240) touches the inner circlip (2300). The adjustment ring is now locked between the bearing and the inner circlip.
- 7 Mount the outer ring of the roller bearing. This ring should go into the bearing bracket **straight**.
- 8 Mount the bearing covers (2110) with the gaskets (2160). Place the splash ring (2220) around the pump shaft.
- 9 Mount the shaft seal and the impeller as described in 7.6 and 7.8.
- 10 Mount the coupling.

8 Dimensions

8.1 Connections

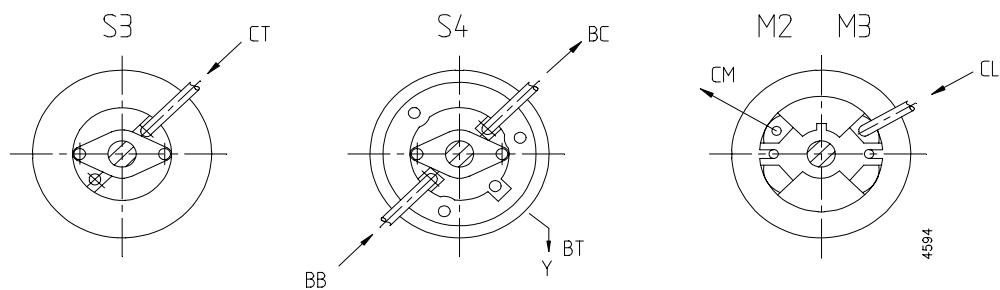


figure 38 Connections bearing groups 1, 2 & 3.

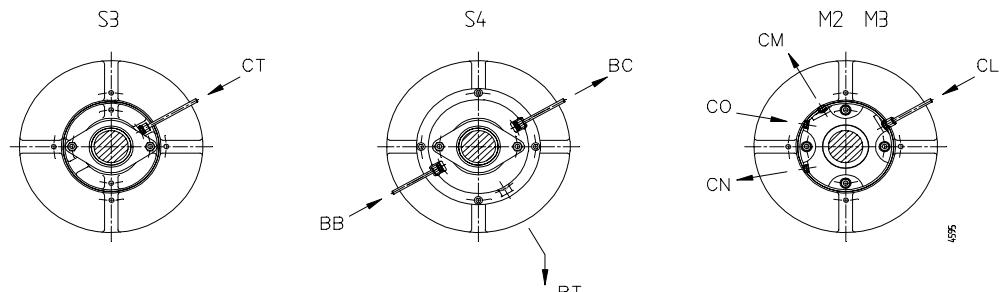


figure 39 Connections bearing group 4.

	Connections	Bearing groups 1, 2 & 3	Bearing group 4
BB	Cooling water inlet	Rp 1/4 - Ø 8	G 1/4
BC	Cooling water outlet	Rp 1/4 - Ø 8	G 1/4
BM	Oil drain	Rp 1/4	G 1/2
BT	Cooling water drain	Rp 1/4	G 1/4
BV	Oil filling plug	Rp 1/4	G 1/2
BW	Constant level oiler	Rp 1/4	G 1/4
CL	Flushing liquid inlet	G 1/4	G 1/4
CM	Shaft sealing vent	G 1/4	G 1/4
CN	Quenching liquid drain	--	G 1/4
CO	Quenching liquid inlet	--	G 1/4
CT	Lantern ring inlet	Rp 1/4 - Ø 8	G 1/4

8.2 Dimension print pump bearing groups 1,2 & 3

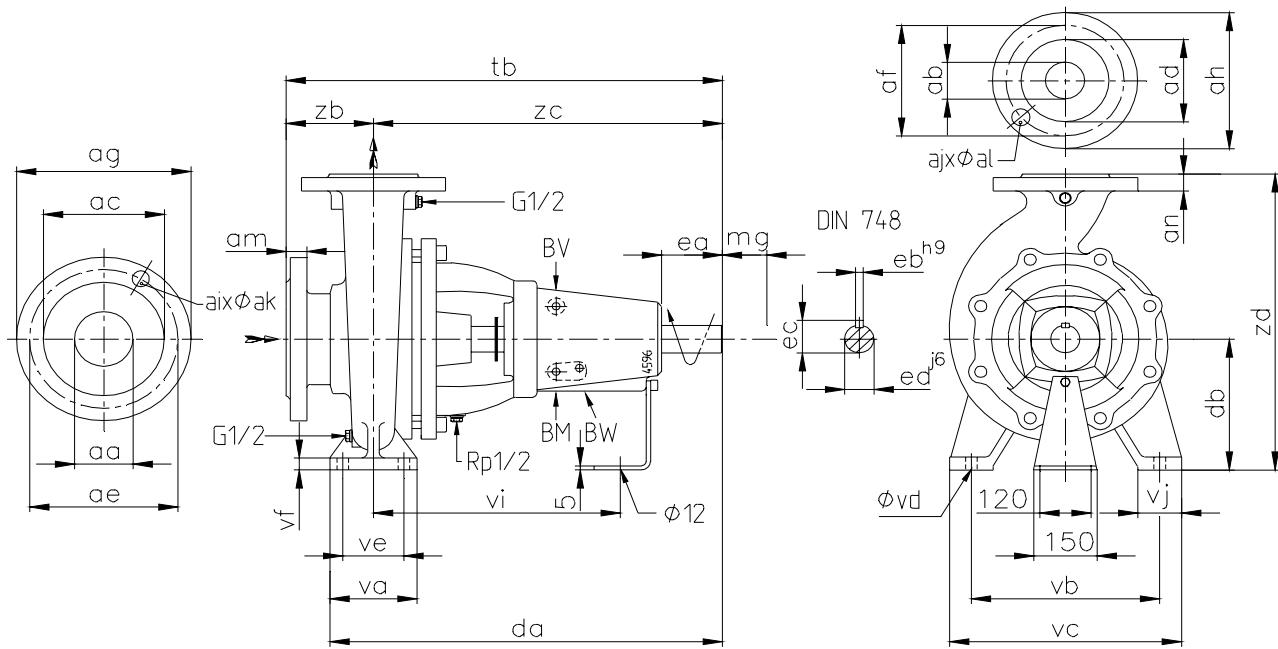


figure 40 Dimension print pump bearing groups 1,2 & 3.

8.3 Pump dimensions bearing groups 1,2 & 3

See fig. 40.

aa	ac	ae	ag	ai*ak	am
ab	ad	af	ah	aj*al	an
ISO 7005 PN 16					
32	78	100	140	4*18	18
40	88	110	150	4*18	18
50	102	125	165	4*18	20
65	122	145	185	4*18	20
80	138	160	200	8*18	22
100	158	180	220	8*18	22
125	188	210	250	8*18	24
150	212	240	285	8*23	24
200	268	295	340	8*23	26
250	320	350	395	12*23	28
300	370	400	445	12*23	28

* aa/ab 200-250-300: ISO 7005 PN 10

ISO 7005 ≈ DIN 2533 / DIN 2532

CN	aa	ab	da	db	ea	eb	ec	ed	mg	tb	va	vb	vc	vd	ve	vf	vi	vj	zb	zc	zd	[kg]
32-125	50	32	410	112	45	8	27	24	100	440	100	140	190	14	70	10	268	50	80	360	252	32
32-160			410	132	45	8	27	24	100	440	100	190	240	14	70	12	268	50	80	360	292	34
32-200			410	160	45	8	27	24	100	440	100	190	240	14	70	12	268	50	80	360	340	35
32-250			423	180	45	8	27	24	100	460	125	250	320	14	95	14	268	65	100	360	405	45
40-125	65	40	410	112	45	8	27	24	100	440	100	160	210	14	70	10	268	50	80	360	252	32
40-160			410	132	45	8	27	24	100	440	100	190	240	14	70	12	268	50	80	360	292	38
40-200			410	160	45	8	27	24	100	460	100	212	265	14	70	12	268	50	100	360	340	46
40-250			423	180	45	8	27	24	100	460	125	250	320	14	95	14	268	65	100	360	405	55
40-315			533	200	75	10	35	32	100	595	125	280	345	14	95	14	346	65	125	470	450	70
50-125	65	50	410	132	45	8	27	24	100	460	100	190	240	14	70	10	268	50	100	360	292	33
50-160			410	160	45	8	27	24	100	460	100	212	265	14	70	12	268	50	100	360	340	40
50-200			410	160	45	8	27	24	100	460	100	212	265	14	70	12	268	50	100	360	360	55
50-250			423	180	45	8	27	24	100	460	125	250	320	14	95	14	268	65	100	360	405	65
50-315			533	225	75	10	35	32	100	595	125	280	345	14	95	14	346	65	125	470	505	80
65-125	80	65	423	160	45	8	27	24	100	460	125	212	280	14	95	10	268	65	100	360	340	44
65-160			423	160	45	8	27	24	100	460	125	212	280	14	95	12	268	65	100	360	360	50
65-200			423	180	45	8	27	24	140	460	125	250	320	14	95	14	268	65	100	360	405	65
65-250			550	200	75	10	35	32	140	570	160	280	360	18	120	14	346	80	100	470	450	85
65-315			550	225	75	10	35	32	140	595	160	315	400	18	120	16	346	80	125	470	505	95
80-160	100	80	423	180	45	8	27	24	140	485	125	250	320	14	95	14	268	65	125	360	405	50
80-200	100		533	180	75	10	35	32	140	595	125	280	345	14	95	14	346	65	125	470	430	75
80-250	100		55	225	75	10	35	32	140	595	160	315	400	18	120	15	346	80	125	470	480	88
80-315	100		550	250	75	10	35	32	140	595	160	315	400	18	120	16	346	80	125	470	565	115
80-400	125		610	280	110	12	45	42	140	655	160	355	435	18	120	18	368	80	125	530	635	150
100-125	100	100	423	180	45	8	27	24	100	485	125	250	320	14	95	14	268	65	125	360	430	70
100-160	125		550	200	75	10	35	32	100	595	160	280	360	18	120	15	346	80	125	470	515	85
100-200	125		550	200	75	10	35	32	140	595	160	280	360	18	120	15	346	80	125	470	480	90
100-250	125		550	225	75	10	35	32	140	610	160	315	400	18	120	16	346	80	140	470	505	110
100-315	125		550	250	75	10	35	32	140	610	160	315	400	18	120	18	346	80	140	470	565	122
100-400	125		630	280	110	12	45	42	140	670	200	400	500	23	150	20	368	100	140	530	635	185
125-125	125	125	423	225	45	8	27	24	100	500	125	250	320	14	95	14	268	65	140	360	525	65
125-250	150		550	250	75	10	35	32	140	610	160	315	400	18	120	18	346	80	140	470	605	130
125-315	150		630	280	110	12	45	42	140	670	200	400	500	23	150	20	368	100	140	530	635	185
125-400	150		630	315	110	12	45	42	140	670	200	400	500	23	150	20	368	100	140	530	715	200

CN	aa	ab	da	db	ea	eb	ec	ed	mg	tb	va	vb	vc	vd	ve	vf	vi	vj	zb	zc	zd	[kg]
150-125	150	150	440	280	45	8	27	24	140	520	160	315	400	18	120	18	268	80	160	360	680	104
150-160	150		550	250	75	10	35	32	100	630	160	315	400	18	120	18	346	80	160	470	565	108
150-200	150		550	250	75	10	35	32	140	630	160	315	400	18	120	18	346	80	160	470	565	130
150-250	200		630	280	110	12	45	42	140	690	200	400	500	23	150	20	368	100	160	530	680	175
150-315	200		630	280	110	12	45	42	140	690	200	450	550	23	150	22	368	100	160	530	680	185
150-400	200		630	315	110	12	45	42	140	690	200	450	550	23	150	22	368	100	160	530	765	220
200-160	200	200	570	280	75	10	35	32	140	670	200	400	500	23	150	20	346	100	200	470	680	160
200-200	200	200	570	280	75	10	35	32	100	670	200	400	500	23	150	20	346	100	200	470	680	170
250-200	250	250	630	315	110	12	45	42	140	730	200	450	550	23	150	22	368	100	200	530	765	240
300-200	300	300	630	450	110	12	45	42	140	780	200	500	600	23	150	22	368	100	250	530	1050	365

8.4 Dimension print pump bearing group 4

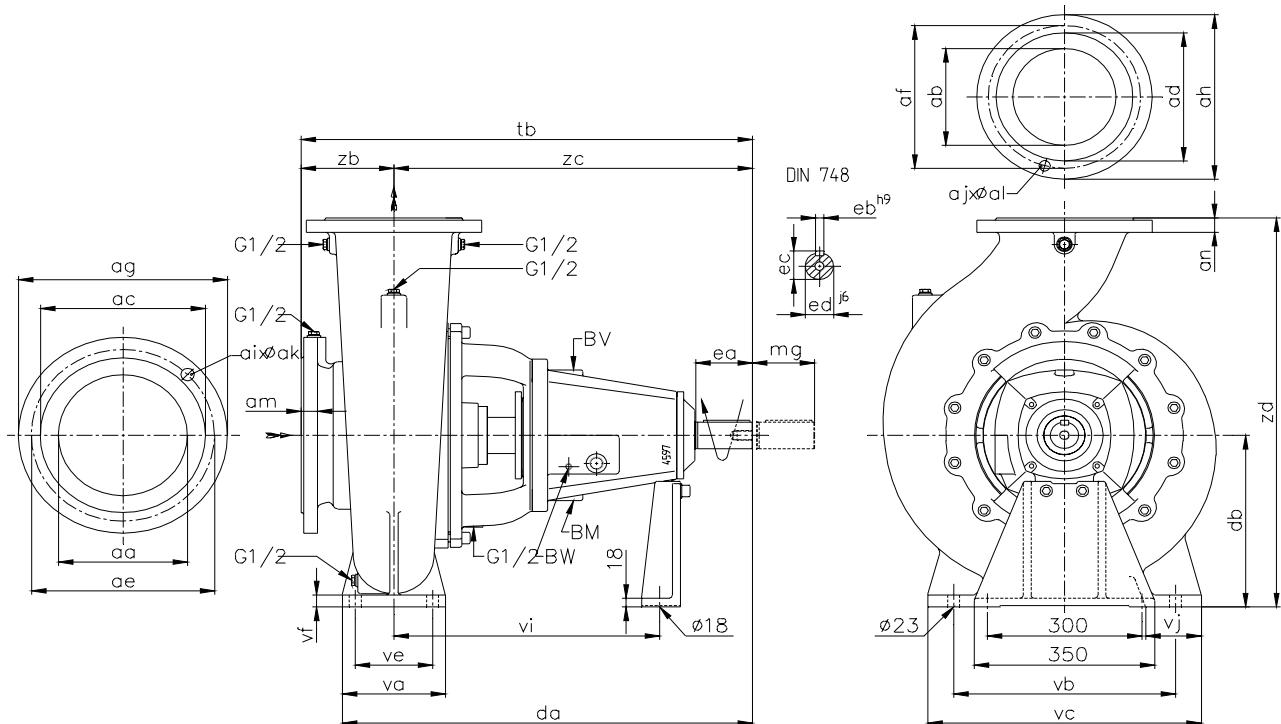


figure 41 Dimension print pump bearing group 4.

8.5 Pump dimensions pump bearing group 4

See fig. 41.

aa	ac	ae	ag	ai*ak	am
ab	ad	af	ah	aj*al	an
ISO 7005 PN 16					
125	188	210	250	8*18	26
150	212	240	285	8*22	26
200	268	295	340	12*22	30
250	320	355	405	12*26	32
300	378	410	460	12*26	32

ISO 7005 ≈ DIN 2533

CN	aa	ab	da	db	ea	eb	ec	ed	mg	tb	va	vb	vc	vd	ve	vf	vi	vj	zb	zc	zd	[kg]
125 -500	200	125	780	400	110	16	59	55	200	880	200	560	660	23	150	25	500	105	200	680	900	430
150B -400	250	150	790	355	110	16	59	55	200	890	200	430	530	23	150	25	510	105	200	690	855	380
150 -500	250	150	785	450	110	16	59	55	200	915	200	560	660	23	150	25	505	105	230	685	1000	420
200 -250	250	200	796	355	110	16	59	55	200	956	200	430	530	23	150	25	516	105	260	696	780	340
200 -315	250	200	795	355	110	16	59	55	200	875	200	430	530	23	150	25	515	105	180	695	805	350
200 -400	300	200	795	400	110	16	59	55	250	925	200	560	660	23	150	25	515	105	230	695	950	470
250 -250	300	250	816	400	110	16	59	55	250	976	200	560	660	23	150	25	536	105	260	716	950	450
250 -315	300	250	800	375	110	10	59	55	250	930	200	560	660	23	150	25	520	105	230	700	875	405
300 -250	300	300	820	450	110	16	59	55	250	970	200	560	660	23	150	25	540	105	250	720	1000	465
300 -315	300	300	820	450	110	16	59	55	250	950	200	560	660	23	150	25	540	105	230	720	1000	475

8.6 Dimension print pump and motor with standard coupling

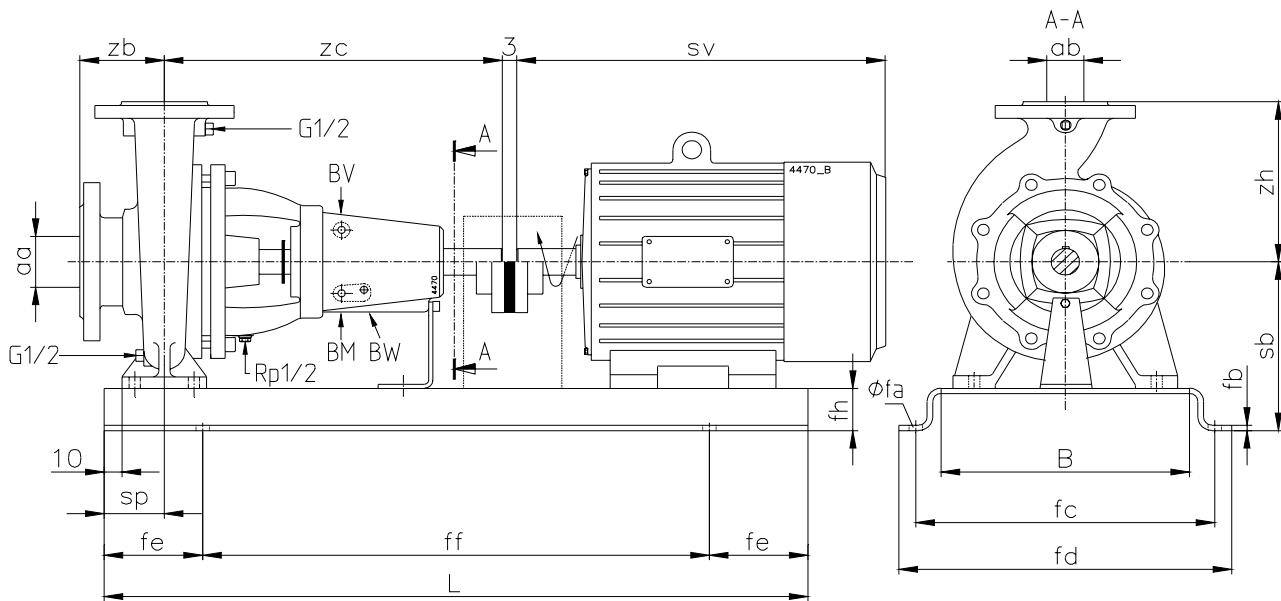


figure 42 Dimension print pump and motor with standard coupling - bearing gr. 1, 2 & 3.

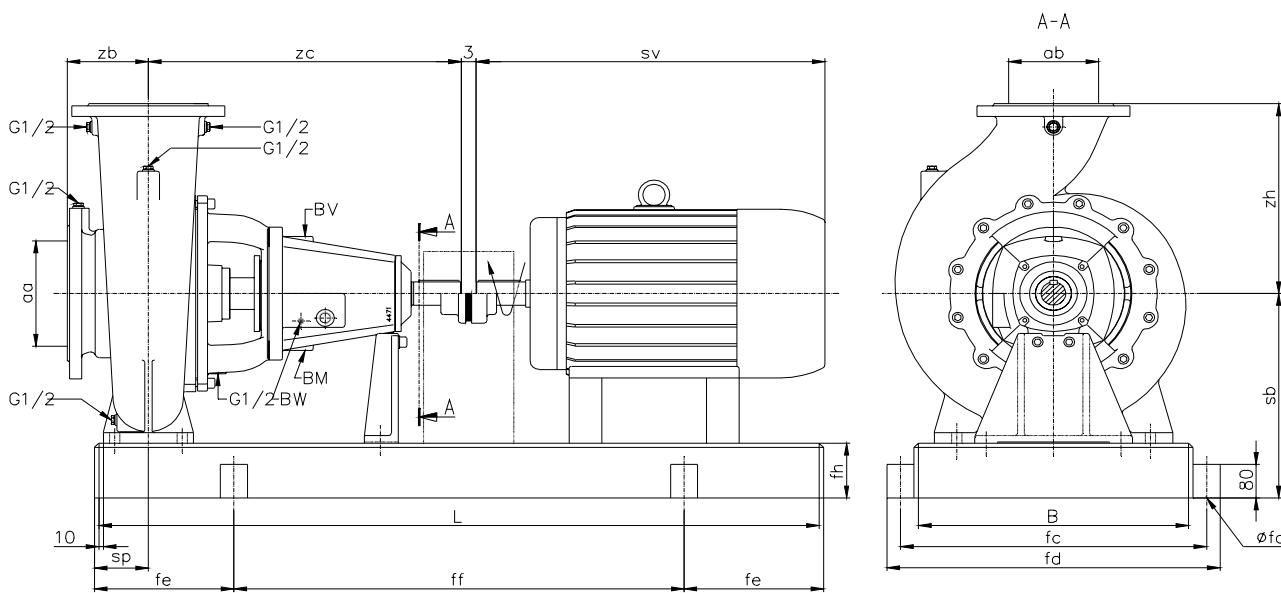


figure 43 Dimension print pump and motor with standard coupling - bearing group 4.

8.7 Dimensions pump and motor with stand. coupl. - bearing gr. 1, 2 & 3

See fig. 42.

CN	ISO 7005 PN16*				IEC motor IP54																			
					71	80	90 S	90 L	100 L	112 M	132 S	132 M	160 M	160 L	180 M	180 L	200 L	225 S	225 M	250 M	280 S	280 M		
	aa	ab	sp	zb	zc	zh																	sv max	
32-125	50	32	60	80	360	140	sb	157	157	157	157	157	157											
						X	1	1	1	1	1	1												
32-160	50	32	60	80	360	160	sb	177	177	177	177	177	177	177	177									
						X	1	1	1	1	1	1	1	1										
32-200	50	32	60	80	360	180	sb	205	205	205	205	205	205	205	205			223						
						X	1	1	1	1	1	1	1	1			2							
32-250	50	32	72	100	360	225	sb		243	243	243	243	243	243	243	243		243	243					
						X	2	2	2	2	2	2	2	2		2	2							
40-125	65	40	60	80	360	140	sb	157	157	157	157	157	157	157	157									
						X	1	1	1	1	1	1	1	1										
40-160	65	40	60	80	360	160	sb	177	177	177	177	177	177	177	177		223							
						X	1	1	1	1	1	1	1	1		2								
40-200	65	40	60	100	360	180	sb		205	205	205	205	205	205	205		223							
						X	1	1	1	1	1	1	1	1		2								
40-250	65	40	72	100	360	225	sb		243	243	243	243	243	243	243		243	243	260					
						X	2	2	2	2	2	2	2	2		2	2	3						
40-315	65	40	72	125	470	250	sb				280	280	280	280	280		280							
						X				3	3	3	3	3		3								
50-125	65	50	60	100	360	160	sb	177	177	177	177	177	177	177	177		223							
						X	1	1	1	1	1	1	1	1		2								
50-160	65	50	60	100	360	180	sb	205	205	205	205	205	205	205	205		223							
						X	1	1	1	1	1	1	1	1		2								
50-200	65	50	60	100	360	200	sb		205	205	205	205	205	205	205		223	223	260		290			
						X	1	1	1	1	1	1	1	1		2	2	3		4				
50-250	65	50	72	125	360	225	sb		243	243	243	243	243	243	243		243	243	260		290			
						X	2	2	2	2	2	2	2	2		2	2	3		4				
50-315	80	50	72	125	470	280	sb				305	305	305	305	305		305	305						
						X				3	3	3	3	3		3								
65-125	80	65	72	100	360	180	sb		205	205	205	205	205	205	205		223							
						X	1	1	1	1	1	1	1	1		2								
65-160	80	65	72	100	360	200	sb		205	205	205	205	205	205	205		223	223	260		290			
						X	1	1	1	1	1	1	1	1		2	2	3		4				
65-200	80	65	72	100	360	225	sb		243	243	243	243	243	243	243		243	243	243		290			
						X	2	2	2	2	2	2	2	2		2	2	3		4				
65-250	80	65	90	125	470	250	sb			280	280	280	280	280	280	280		280	280	280	280	290	315	
						X			3	3	3	3	3	3	3		3	3	3	3	3	4		
65-315	80	65	90	125	470	280	sb				315	315	315	315	315		315	315	315					
						X			4	4	4	4	4	4	4		4	4	4	4				
80-160	100	80	72	125	360	225	sb			243	243	243	243	243		243	243	260		290				
						X			2	2	2	2	2		2	2	3		4					
80-200	100	80	72	125	470	250	sb			260	260	260	260	260		260	260	260		290	315	380	410	
						X			3	3	3	3	3		3	3	3		4		4	6		
80-250	100	80	90	125	470	280	sb			290	290	290	290	290		290	290	290		290	315	380	410	
						X			4	4	4	4	4		4	4	4		4		4	6		
80-315	100	80	90	125	470	315	sb				340	340	340	340	340		340	340	340					
						X			4	4	4	4	4		4	4	4		4		4			
80-400	125	80	90	125	530	355	sb									370	370	370	370	370	370	370	380	
						X									4	4	4	4	4	4	4	5		
100-125	100	100	72	125	360	250	sb		243	243	243	243	243		243									
						X	2	2	2	2		2		2										
100-160	125	100	90	125	470	315	sb			280	280	280	280			280	280	280		290				
						X			3	3	3	3			3	3	3		4					
100-200	125	100	90	125	500	280	sb				280	280	280	280			280	280	280		290	315	380	410
						X				3	3	3	3			3	3	3		4		4	6	
100-250	125	100	90	140	530	280	sb				315	315	315	315			315	315	315		315	315	380	410
						X				4	4	4	4			4	4	4		4		4	6	

CN	ISO 7005 PN16*				IEC motor IP54																				
					71	80	90 S	90 L	100 L	112 M	132 S	132 M	160 M	160 L	180 M	180 L	200 L	225 S	225 M	250 M	280 S	280 M			
	aa	ab	sp	zb	zc	zh																			sv max
100-315	125	100	90	140	530	315	sb						340	340	340	340	340	340	340	340	340	340	340	340	
							X						4	4	4	4	4	4	4	4	4	4	4		
100-400	125	100	110	140	530	355	sb						370	370	370	370	370	370	370	370	410	410	410	410	
							X						4	4	4	4	4	4	4	4	4	6	6	6	
125-125	125	125	72	140	360	300	sb					288	288	288	288		288								
							X					2	2	2	2		2								
125-250	150	125	90	140	530	355	sb					340	340	340	340	340	340	340	340	340	340	340	340	340	
							X					4	4	4	4	4	4	4	4	4	4	4	4		
125-315	150	125	110	140	530	355	sb						370	370	370	370	370	370	370	370	410	410	410	410	
							X						4	4	4	4	4	4	4	4	4	6	6	6	
125-400	150	125	110	140	530	400	sb						405	405	405	405	405	405	405	405	445	445	445	445	
							X						4	4	4	4	4	4	4	4	4	6	6	6	
150-125	150	150	90	160	360	400	sb					370	370	370											
							X					4	4	4											
150-160	150	150	90	160	470	315	sb					340	340	340	340		340		340		340		340	380	
							X					4	4	4	4		4		4		4		4	6	
150-200	150	150	90	160	470	315	sb					340	340	340	340		340		340		340		340	380	
							X					4	4	4	4		4		4		4		4	6	
150-250	200	150	110	160	530	400	sb						370	370	370	370	370	370	370	410	410	410	410	410	
							X						4	4	4	4	4	4	4	4	4	6	6	6	
150-315	200	150	110	160	530	400	sb						410	410	410	410	410	410	410	410	410	410	410	410	
							X						6	6	6	6	6	6	6	6	6	6	6	6	
150-400	200	150	110	160	530	450	sb													445	445	445	445	445	
							X												6	6	6	6	6	6	
200-160	200	200	110	200	470	400	sb						370	370	370										
							X						4	4	4										
200-200	200	200	110	200	470	400	sb						370	370	370	370	370	370	370	370					
							X						4	4	4	4	4	4	4	4	4				
250-200	250	250	110	200	530	450	sb										445	445	445	445	445				
							X										6	6	6	6	6				
300-200	300	300	110	250	530	600	sb											580	580	580	580	580	580	580	
							X										6	6	6	6	6	6	6		

X = Baseplate number

ISO 7005 ≈ DIN 2533 / DIN 2532

8.8 Dimensions pump and motor with stand. coupl. - bearing gr. 4

See fig. 43.

CN	ISO 7005 PN16		IEC motor																	
			160 L	180 M	180 L	200 L	225 S	225 M	250 M	280 S	280 M	315 S	315 M	315 L	315 LX	355 S				
	aa	ab	sp	zb	zc	zh	sv max	675	700	735	805	835	860	970	1065	1115	1235	1260	1340	1590
125-500	200	125	110	200	680	500	sb				530	530	530	530	530	560	560	560	560	560
						x				12	12	12	12	12	14	14	14	14	14	16
150B-400	250	150	110	200	690	500	sb				485	485	485	485	485	485	515	515	515	515
						x				11	11	11	11	11	13	14	14	14	14	
150-500	250	150	110	230	685	550	sb								580	580	610	610	610	610
						x								12	12	14	14	14	14	
200-250	250	200	110	260	696	425	sb	485	485	485	485	485	485	485	485					
						x	11	11	11	11	11	11	11	11						
200-315	250	200	110	180	695	450	sb			485	485	485	485	485	485	485	515			
						x			11	11	11	11	11	11	13	14				
200-400	300	200	110	230	695	550	sb				530	530	530	530	530	560	560	560	560	560
						x				12	12	12	12	12	14	14	14	14	14	16
250-250	300	250	110	260	716	550	sb			530	530	530	530	530	560	560	560			
						x			12	12	12	12	12	14	14	14				
250-315	300	250	110	230	700	500	sb				505	505	505	505	505	535	535	535		
						x			12	12	12	12	12	14	14	14				
300-250	300	300	110	250	720	550	sb				580	580	580	610	610	610				
						x				12	12	12	14	14	14					
300-315	300	300	110	230	720	550	sb							580	580	610	610	610	610	
						x							12	12	14	14	14	14	,	

X = Baseplate number

8.9 Dimension print pump and motor with spacer coupling

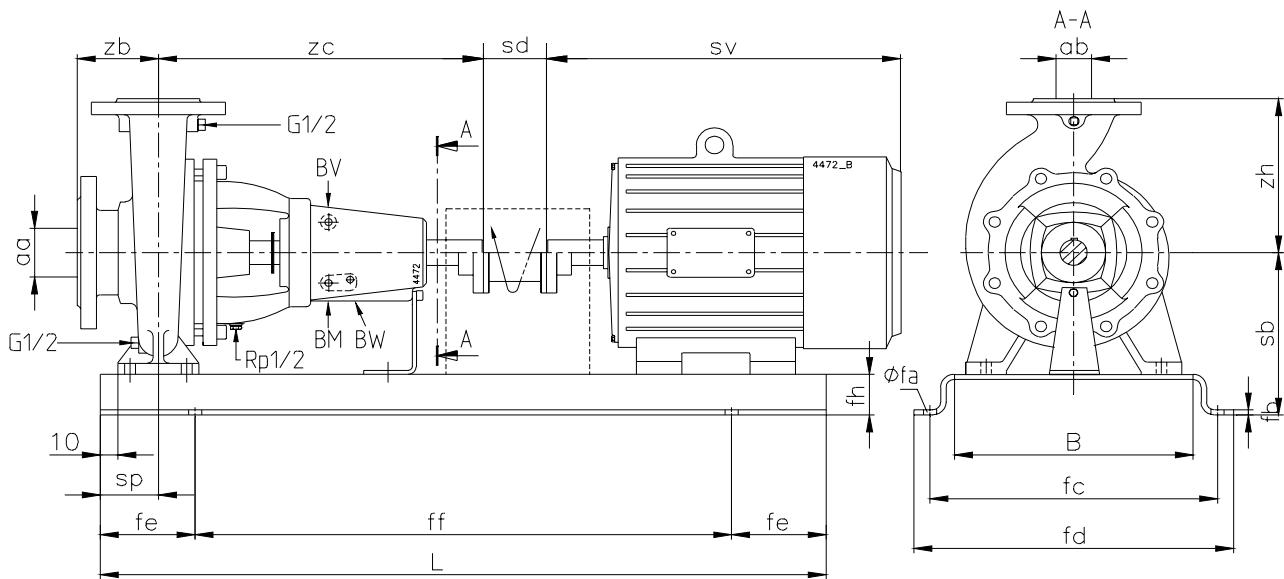


figure 44 Dimension print pump and motor with spacer coupling - bearing gr. 1, 2 & 3.

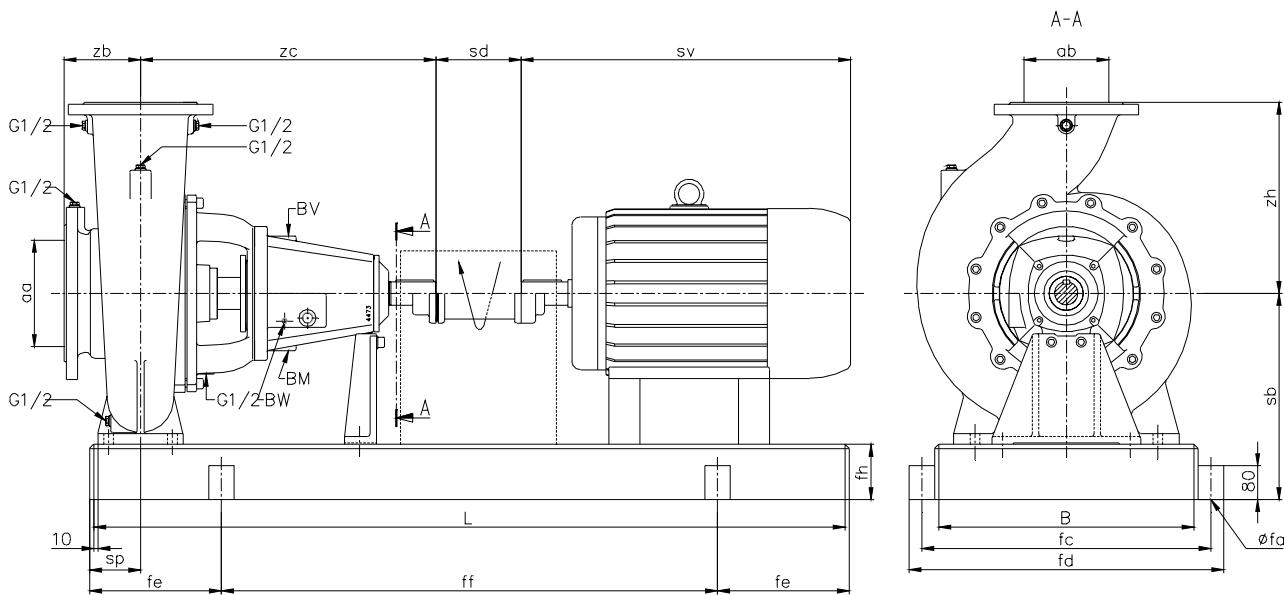


figure 45 Dimension print pump and motor with spacer coupling - bearing group 4

8.10 Dimensions pump and motor with spacer coupl. - bearing gr. 1, 2 & 3

See fig. 44.

CN	ISO 7005 PN16*							IEC motor IP54																								
								71	80	90 S	90 L	100 L	112 M	132 S	132 M	160 M	160 L	180 M	180 L	200 L	225 S	225 M	250 M	280 S	280 M							
	aa	ab	sd	sp	zb	zc	zh		235	270	300	325	390	425	485	520	630	670	700	735	805	835	860	960	1065	1115						
32-125	50	32	100	60	80	360	140	sb	157	157	157	157	175	175																		
							X		1	1	1	1	2	2																		
32-160	50	32	100	60	80	360	160	sb	177	177	177	177	195	195	195	195																
							X		1	1	1	1	2	2	2																	
32-200	50	32	100	60	80	360	180	sb	205	205	205	205	223	223	223	223																
							X		1	1	1	1	2	2	2																	
32-250	50	32	100	72	100	360	225	sb		243	243	243	243	243	243	243		260	260													
							X		2	2	2	2	2	2	2		3	3	3													
40-125	65	40	100	60	80	360	140	sb	157	157	157	157	175	175	175	195																
							X		1	1	1	1	2	2	2																	
40-160	65	40	100	60	80	360	160	sb	177	177	177	177	195	195	195	195		223														
							X		1	1	1	1	2	2	2		2															
40-200	65	40	100	60	100	360	180	sb		205	205	205	205	223	223	223	223		223													
							X		1	1	1	1	2	2	2		2															
40-250	65	40	100	72	100	360	225	sb		243	243	243	243	243	243	243		260	260	260												
							X		2	2	2	2	2	2	2		3	3	3													
40-315	65	40	100	72	125	470	250	sb					280	280	280	280																
							X						3	3	3	3																
50-125	65	50	100	60	100	360	160	sb	177	177	177	177	195	195	195	195		223														
							X		1	1	1	1	2	2	2		2															
50-160	65	50	100	60	100	360	180	sb	205	205	205	205	205	223	223	223	223		223													
							X		1	1	1	1	2	2	2		2															
50-200	65	50	100	60	100	360	200	sb		205	205	205	205	223	223	223	223		223	240	260		290									
							X		1	1	1	1	2	2	2		2	3	3	3	4											
50-250	65	50	100	72	125	360	225	sb		243	243	243	243	243	243	243		260	260	260		290										
							X		2	2	2	2	2	2	2		3	3	3	3	4											
50-315	80	50	100	72	125	470	280	sb					305	305	305	305	305	305														
							X						3	3	3	3	3	3	3	3	3	3	5	5	5							
65-125	80	65	100	72	100	360	180	sb		205	205	223	223	223	223	223		240														
							X		1	1	2	2	2	2	2		3															
65-160	80	65	100	72	100	360	200	sb		205	205	223	223	223	223	223		240	240	260		290										
							X		1	1	2	2	2	2	2		3	3	3	3	4											
65-200	80	65	140	72	100	360	225	sb		243	243	243	243	243	243	243		260	260	260		290										
							X		2	2	2	2	2	2	2		3	3	3	3	4											
65-250	80	65	140	90	125	470	250	sb					280	280	280	280	280	280	280	280	280	280	300		325							
							X						3	3	3	3	3	3	3	3	3	3	5	5	5							
65-315	80	65	140	90	125	470	280	sb						315	315	315	315	315	315	315	315	315										
							X							4	4	4	4	4	4	4	4	4	4	4	4							
80-160	100	80	140	72	125	360	225	sb					243	243	243	243	243	243		260	260	260		290								
							X						2	2	2	2	2		3	3	3	3	4									
80-200	100	80	140	72	125	470	250	sb						260	260	260	260	260	260	260	260	260	260	300		325	380	410				
							X						3	3	3	3	3	3	3	3	3	3	5	5	6	6						
80-250	100	80	140	90	125	470	280	sb						290	290	290	290	290	290	290	290	290	290	300		325	350	410				
							X							4	4	4	4	4	4	4	4	4	4	5	5	6	6					
80-315	100	80	140	90	125	470	315	sb							340	340	340	340	340	340	340	340	340	350								
							X								4	4	4	4	4	4	4	4	4	5								
80-400	125	80	140	90	125	530	355	sb									370	370	370	370	380	380	380	380	380	380		325	380	410	410	
							X															4	4	4	5	5	5	5	6	6		
100-125	100	100	100	72	125	360	250	sb					243	243	243	243	243	243		260												
							X						2	2	2	2			2													
100-160	125	100	100	90	125	470	315	sb								280	280	280	280	280	280	280	280	280	280		300					
							X								3	3	3	3	3	3	3	3	3	3	5							
100-200	125	100	140	90	125	500	280	sb									280	280	280	280	280	280	280	280	280	280		300		325	380	410
							X										3	3	3	3	3	3	3	3	3	5	5	6	6			
100-250	125	100	140	90	140	530	280	sb									315	315	315	315	315	315	315	315	315	315		325	325	380	410	410
							X										4	4	4	4	4	4	4	4	4	4	5	5	6	6	6	6

CN	ISO 7005 PN16*								IEC motor IP54																											
	71	80	90 S	90 L	100 L	112 M	132 S	132 M	160 M	160 L	180 M	180 L	200 L	225 S	225 M	250 M	280 S	280 M																		
	aa	ab	sd	sp	zb	zc	zh		235	270	300	325	390	425	485	520	630	670	700	735	805	835	860	960	1065	1115										
100-315	125	100	140	90	140	530	315	sb					340	340	340	340	340	340	340	350	350	350														
								X					4	4	4	4	4	4	4	5	5	5														
100-400	125	100	140	110	140	530	355	sb					370	370	410	410	410	410	410	410	410	410	410													
								X					4	4	6	6	6	6	6	6	6	6	6													
125-125	125	125	100	72	140	360	300	sb				288	288	288	288		305																			
								X				2	2	2	2		3																			
125-250	150	125	140	90	140	530	355	sb				340	340	340	340	340	340	340	340	350	350															
								X				4	4	4	4	4	4	4	4	5	5															
125-315	150	125	140	110	140	530	355	sb				370	370	410	410	410	410	410	410	410	410	410														
								X				4	4	6	6	6	6	6	6	6	6	6														
125-400	150	125	140	110	140	530	400	sb				405	445	445	445	445	445	445	445	445	445	445														
								X				4	6	6	6	6	6	6	6	6	6	6														
150-125	150	150	140	90	160	360	400	sb				370	370	370																						
								X				4	4	4																						
150-160	150	150	140	90	160	470	315	sb				340	340	340	340			340		350		350	380													
								X				4	4	4	4			4		5		5	6													
150-200	150	150	140	90	160	470	315	sb				340	340	340	340	340																				
								X				4	4	4	4	4																				
150-250	200	150	140	110	160	530	400	sb									410	410	410	410	410	410														
								X									6	6	6	6	6	6														
150-315	200	150	140	110	160	530	400	sb									410	410	410	410	410	410	410													
								X									6	6	6	6	6	6	6													
150-400	200	150	140	110	160	530	450	sb											445	445	445	445	445	445	445											
								X											6	6	6	6	6	6	6											
200-160	200	200	140	110	200	470	400	sb									370	370	370																	
								X									4	4	4																	
200-200	200	200	140	110	200	470	400	sb									370	370	370	370	410	410	410	410												
								X									4	4	4	4	6	6	6													
250-200	250	250	140	110	200	530	450	sb												445	445	445	445	445												
								X											6	6	6	6	6													
300-200	300	300	140	110	250	530	600	sb												580	580	580	580	580	580	580										
								X											6	6	6	6	6	6	6											

X = NBaseplate number

ISO 7005 ≈ DIN 2533 / DIN 2532

8.11 Dimensions pump and motor with spacer coupl. - bearing gr. 4

See fig. 45.

CN	ISO 7005 PN16								IEC motor														
			160 L	180 M	180 L	200 L	225 S	225 M	250 M	280 S	280 M	315 S	315 M	315 L	315 LX	355 S	sv max						
	aa	ab	sd	sp	zb	zc	zh	sv max	675	700	735	805	835	860	970	1065	1115	1235	1260	1340	1340	1590	
125-500	200	125	200	110	200	680	500	sb				530	560	560	560	560	560	560	560	560	560	560	560
							x				12	14	14	14	14	14	14	14	14	14	14	16	
150B-400	250	150	200	110	200	690	500	sb				485	485	485	485	485	485	515	515	515	515	515	515
							x				13	13	13	13	13	13	14	14	14	14	15	15	
150-500	250	150	200	110	230	685	550	sb								610	610	610	610	610	610	610	
							x								14	14	14	14	14	14	14	16	
200-250	250	200	200	110	260	696	425	sb	485	485	485	485	485	485	485	485	485	485	485	485	485	485	
							x	11	11	11	13	13	13	13	13	13	13	13	13	13	13	13	
200-315	250	200	200	110	180	695	450	sb				485	485	485	485	485	485	515	515	515	515	515	515
							x				11	13	13	13	13	13	14	14	14	14	14	14	
200-400	300	200	250	110	230	695	550	sb					560	560	560	560	560	560	560	560	560	560	560
							x				14	14	14	14	14	14	14	14	14	15	15	16	
250-250	300	250	250	110	260	716	550	sb					560	560	560	560	560	560	560	560	560	560	560
							x				14	14	14	14	14	14	14	14	14	14	14	14	
250-315	300	250	250	110	230	700	500	sb						535	535	535	535	535	535	535	535	535	535
							x				14	14	14	14	14	14	14	14	14	14	15	15	
300-250	300	300	250	110	250	720	550	sb							610	610	610	610	610	610	610	610	
							x				14	14	14	14	14	14	14	14	14	14	14	14	
300-315	300	300	250	110	230	720	550	sb								610	610	610	610	610	610	610	
							x				14	14	14	14	14	14	14	14	14	15	15	15	

X = Baseplate number

8.12 Baseplate dimensions and weights

8.12.1 Bearing groups 1, 2 & 3

Baseplate number (x)	[mm]									Weigth [kg]
	L	B	fa	fb	fc	fd	fe	ff	fh	
1	800	305	19	6	385	433	120	560	45	20
2	1000	335	19	8	425	473	145	710	63	38
3	1250	375	24	10	485	545	175	900	80	69
4	1250	500	24	10	610	678	175	900	90	79
5	1600	480	24	10	590	658	240	1120	100	107
6	1650	600	24	10	720	788	240	1170	130	129

8.12.2 Bearing group 4

Baseplate number (x)	[mm]								Weigth [kg]
	L	B	fa	fc	fd	fe	ff	fh	
11	1600	600	28	680	740	310	1*1000	130	200
12	1600	710	28	790	850	310	1*1000	130	218
13	1800	600	28	680	740	360	1*1100	130	225
14	2000	710	28	790	850	410	1*1200	160	283
15	2250	750	28	830	890	235	2*900	160	402
16	2350	900	28	980	1040	185	2*1000	160	440

9 Parts

9.1 Ordering parts and spare parts

9.1.1 Order form

You can use the order form included in this manual for ordering parts.

You must always state the following on the order:

- 1 Your **address information**.
- 2 The **quantity**, the **item number** and the **description** of the part.
- 3 The **pump number**.
- 4 In the event of different voltages for the electric motor you should state the correct voltage.

9.1.2 Pump number

When ordering parts for a CombiNorm pump, please quote the pump reference number on your order.

You can find the **pump number** on the **type plate** on the pump and on the label **on the first page of these operating instructions**.

9.1.3 Recommended spare parts

Parts marked with a * are recommended spare parts.

9.2 Pump parts L1-L2

9.2.1 Sectional drawing L1-L2

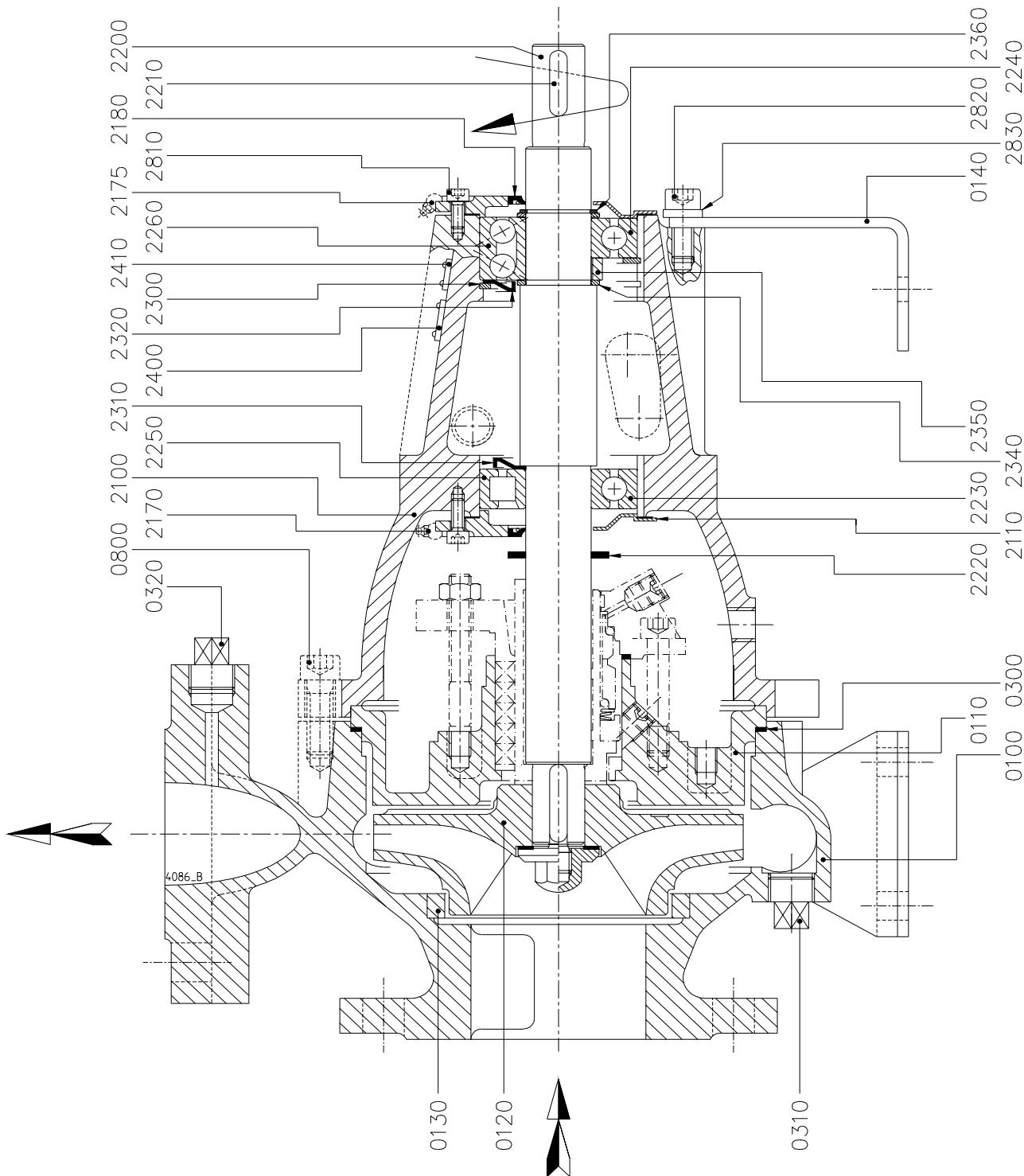


figure 46 CombiNorm with bearing L1 - L2.

9.2.2 Parts list L1-L2

Item	Number		Description	Materials						
	L1	L2		G1	G2	NG1	NG2	B2		
0100	1	1	pump casing	cast iron		nodular cast iron		bronze		
0110	1	1	stuffing box cover	cast iron		nodular cast iron		bronze		
0120*	1	1	impeller	cast iron	bronze	cast iron	bronze	bronze		
0130*	1	1	casing wear ring	cast iron	bronze	cast iron	bronze	bronze		
0140	1	1	bracket support	steel						
0300*	1	1	gasket	-						
0310	1	1	plug	steel			bronze			
0320	1	1	plug	steel			bronze			
0800	**	**	allen screw	steel			st.st.			
2100	1	1	bearing bracket	cast iron						
2110	2	-	bearing cover	cast iron						
2110	-	2	bearing cover	cast iron						
2170	-	1	grease nipple	steel						
2175	-	1	grease nipple	steel						
2180	-	1	sealing ring	rubber						
2200*	1	1	pump shaft	steel alloy			st.st.			
2210*	1	1	coupling key	steel						
2220*	1	1	splash ring	rubber						
2230*	1	-	ball bearing	—						
2240*	1	-	ball bearing	—						
2250*	-	1	roller bearing	—						
2260*	-	1	double row angular contact ball bearing	—						
2300*	1	1	inner circlip	spring steel						
2310*	-	1	nilos ring	steel						
2320*	-	1	nilos ring	steel						
2340	2	2	adjustment ring	steel						
2350	1	-	spacer sleeve	steel						
2360*	1	1	outer circlip	spring steel						
2400	1	1	name plate	stainless steel						
2410	1	1	arrow plate	aluminium						
2810	8	8	allen screw	steel						
2820	1	1	allen screw	steel						
2830	1	1	washer	steel						

st.st. = stainless steel

** Item 0800 dependent on pump type 4, 8, or 12

Item 0130 not for the pump types of bearing bracket 1, except CN 32-250.

9.3 Pump parts L3-L4

9.3.1 Sectional drawing L3-L4

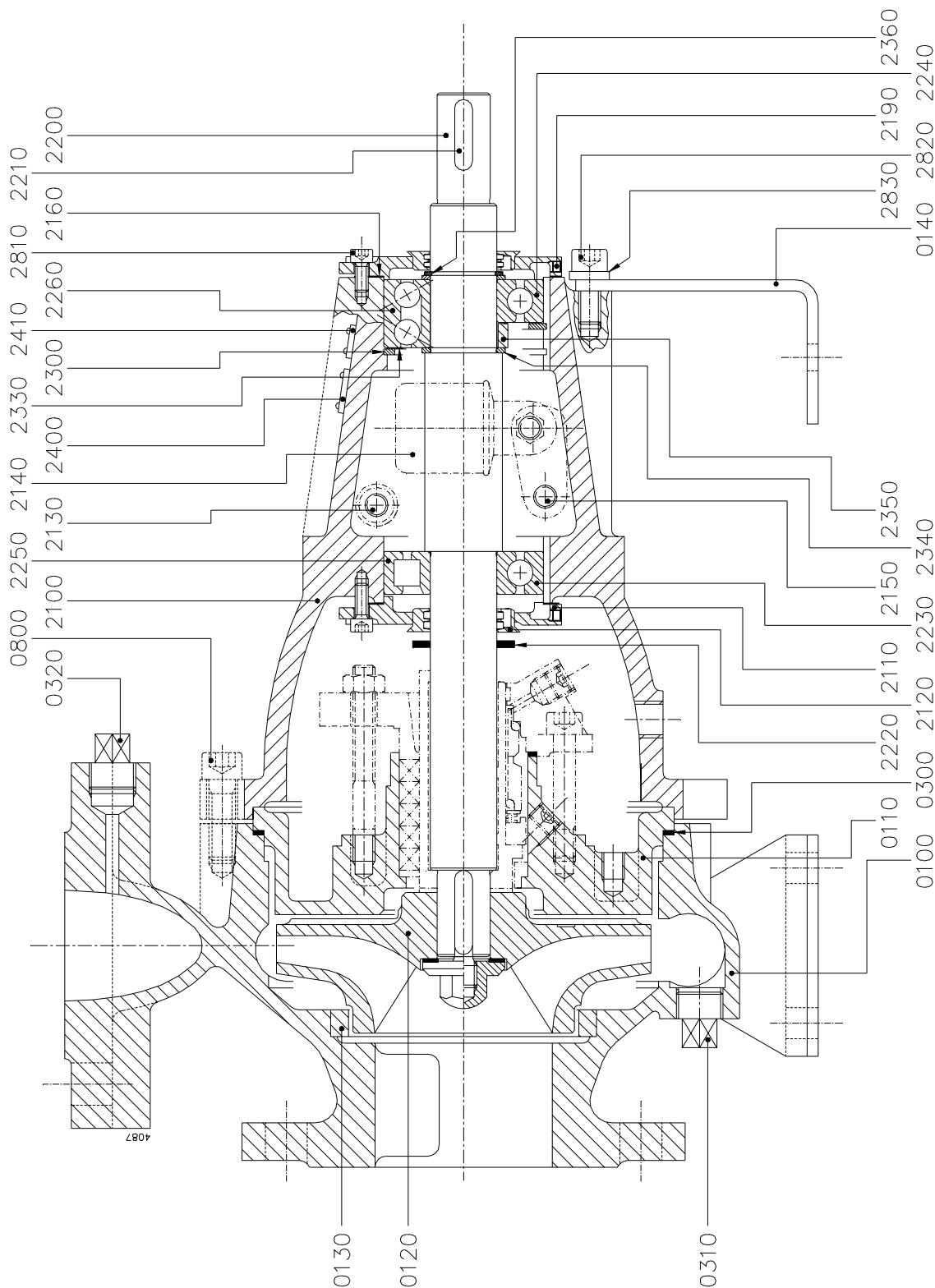


figure 47 CombiNorm with bearing L3 - L4.

9.3.2 Parts list L3-L4

Item	Number		Description	Materials				
	L3	L4		G1	G2	NG1	NG2	B2
0100	1	1	pump casing	cast iron		nodular cast iron		bronze
0110	1	1	stuffing box cover	cast iron		nodular cast iron		bronze
0120*	1	1	impeller	cast iron	bronze	cast iron	bronze	bronze
0130*	1	1	casing wear ring	cast iron	bronze	cast iron	bronze	bronze
0140	1	1	bracket support	steel				
0300*	1	1	gasket	-				
0310	1	1	plug	steel				bronze
0320	1	1	plug	steel				bronze
0800	**	**	allen screw	steel				st.st.
2100	1	1	bearing bracket	cast iron				
2110	2	2	bearing cover	cast iron				
2120*	2	2	oil baffle	bronze				
2130	1	1	oil filler cap	plastic				
2140	1	1	constant level oiler	-				
2150	1	1	plug	steel				
2160*	2	2	gasket	-				
2190	2	2	adjustment screw	stainless steel				
2200*	1	1	pump shaft	steel alloy				st.st.
2210*	1	1	coupling key	steel				
2220*	1	1	splash ring	rubber				
2230*	1	-	ball bearing	—				
2240*	1	-	ball bearing	—				
2250*	-	1	roller bearing	—				
2260*	-	1	double row angular contact ball bearing	—				
2300*	1	1	inner circlip	spring steel				
2330	-	1	adjustment ring	steel				
2340	2	2	adjustment ring	steel				
2350	1	-	spacer sleeve	steel				
2360*	1	1	outer circlip	spring steel				
2400	1	1	name plate	stainless steel				
2410	1	1	arrow plate	aluminium				
2810	8	8	allen screw	steel				
2820	1	1	allen screw	steel				
2830	1	1	washer	steel				

st.st. = stainless steel

** Item 0800 dependent on pump type 4, 8, or 12

Item 0130 not for the pump types of bearing bracket 1, except CN 32-250.

9.4 Pump parts L2 for bearing group 4

9.4.1 Sectional drawing L2 for bearing group 4

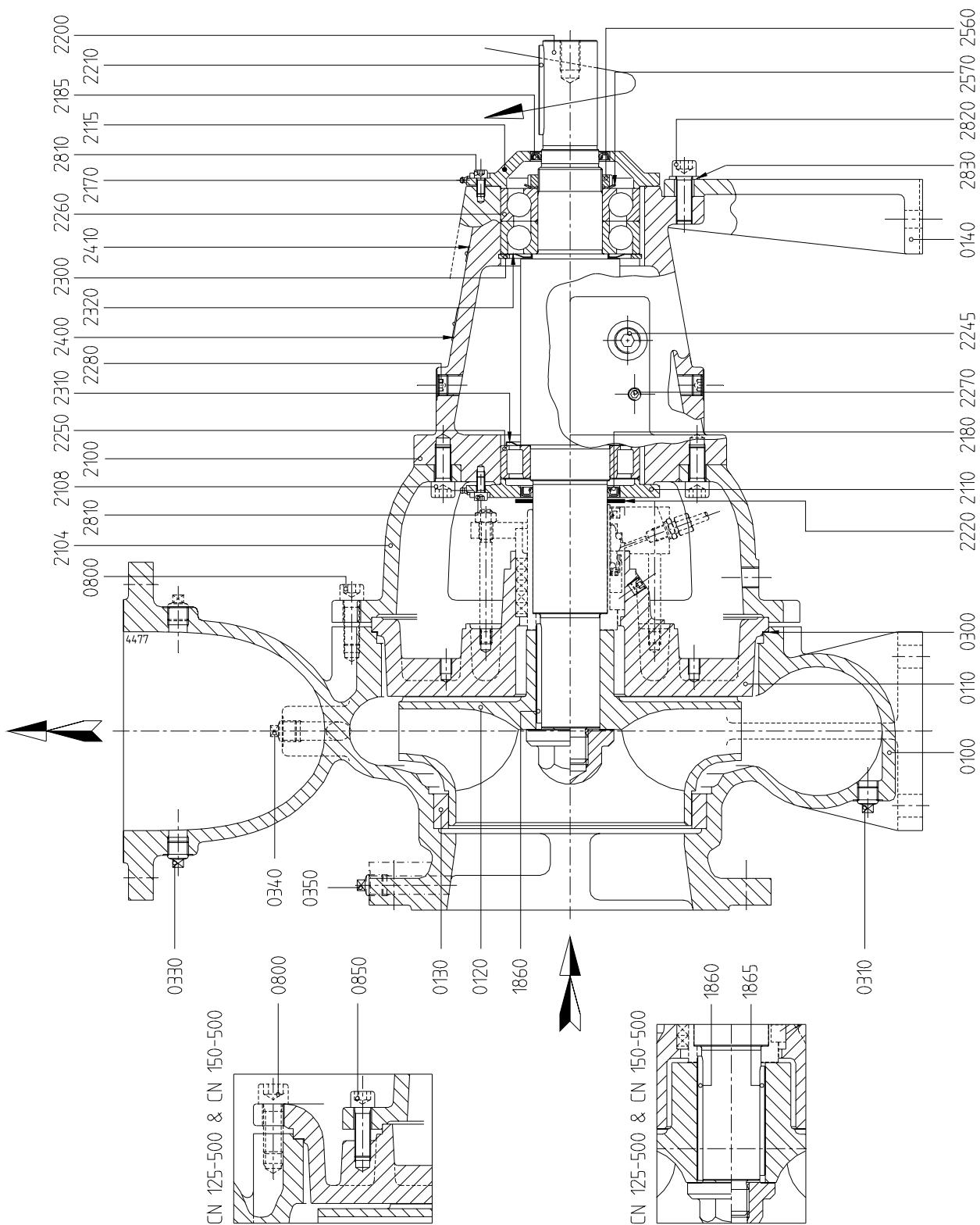


figure 48 CombiNorm with bearing L2 for bearing bracket group 4.

9.4.2 Parts list L2 for bearing group 4

Item	Number	Description	Materials				
			G1	G2	NG1	NG2	B2
0100	1	pump casing		cast iron		nodular cast iron	bronze
0110	1	stuffing box cover		cast iron		nodular cast iron	bronze
0120*	1	impeller	cast iron	bronze	cast iron	bronze	bronze
0130*	1	casing wear ring	cast iron	bronze	cast iron	bronze	bronze
0140	1	bracket support			steel		
0300*	1	gasket			-		
0310	1	plug		cast iron			bronze
0330	1	plug		cast iron			bronze
0340	1	plug		cast iron			bronze
0350	1	plug		cast iron			bronze
0800	**	allen screw		steel			st.st.
0850***	12	allen screw		steel			st.st.
1860	1	impeller key			stainless steel		
1865***	1	impeller key			stainless steel		
2100	1	bearing bracket		cast iron			
2104	1	lantern piece		cast iron			
2108	8	allen screw		steel			
2110	1	bearing cover		cast iron			
2115	1	bearing cover		cast iron			
2170	2	grease nipple		steel			
2180	1	sealing ring		rubber			
2185	1	sealing ring		rubber			
2200*	1	pump shaft		steel alloy		st.st.	
2210*	1	coupling key		steel			
2220*	1	splash ring		rubber			
2245	1	plug		steel			
2250*	1	roller bearing		—			
2260*	2	double row angular contact ball bearing		—			
2270	1	plug		steel			
2280	2	plug		steel			
2300*	1	inner circlip		spring steel			
2310*	1	nilos ring		steel			
2320*	1	nilos ring		steel			
2400	1	name plate		stainless steel			
2410	1	arrow plate		aluminium			
2560*	1	shaft nut		steel			
2570*	1	locking ring		steel			
2810	4	allen screw		steel			
2815	4	allen screw		steel			
2820	2	allen screw		steel			
2830	2	washer		steel			

st.st. = stainless steel

** Number dependent on pump type 8, 12 or 16

*** Applies only to CN 125-500 and CN 150-500

9.5 Pump parts L4 for bearing group 4

9.5.1 Sectional drawing L4 for bearing group 4

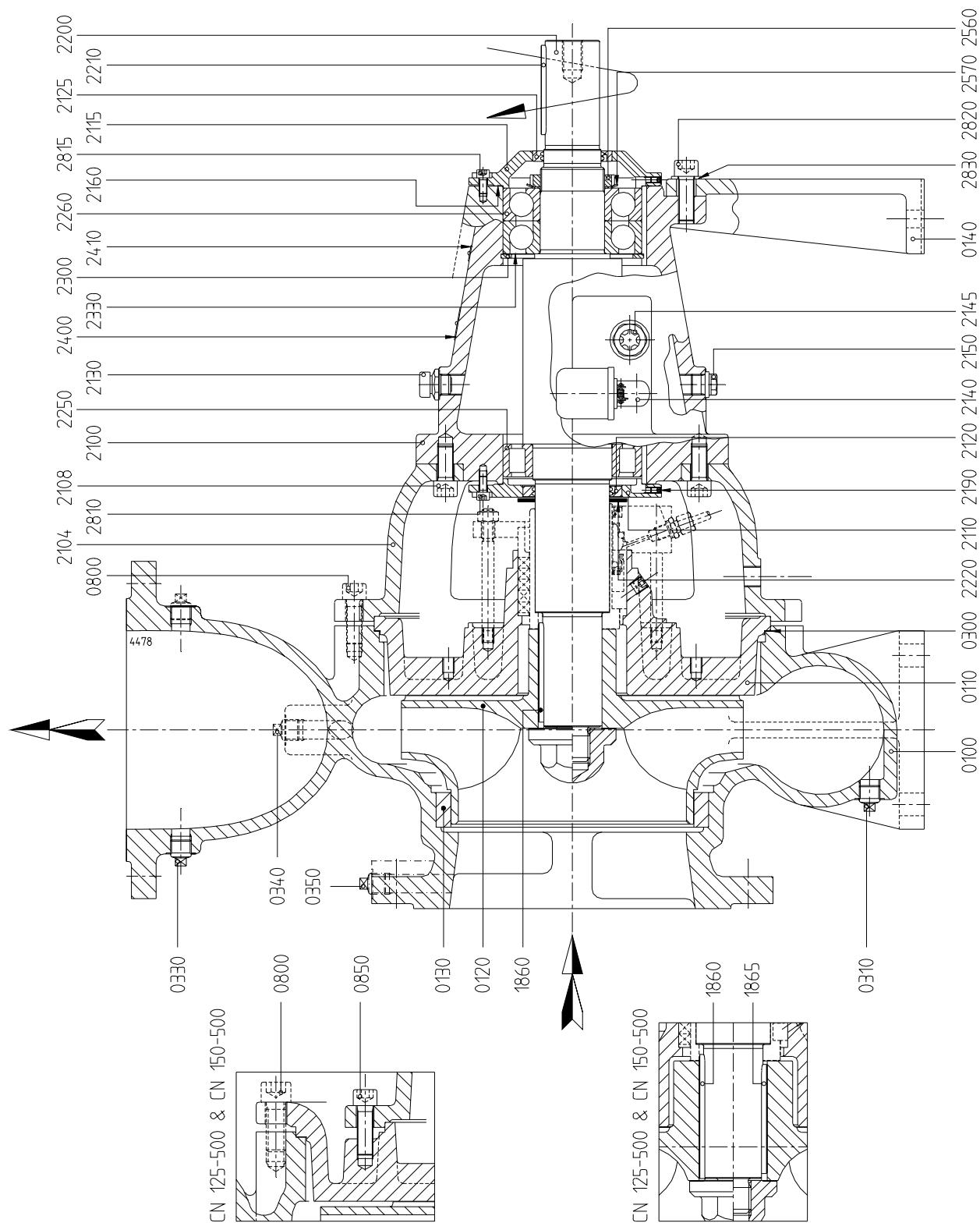


figure 49 CombiNorm with bearing L4 for bearing bracket group 4.

9.5.2 Parts list L4 for bearing group 4

Item	Number	Description	Materials				
			G1	G2	NG1	NG2	B2
0100	1	pump casing		cast iron		nodular cast iron	bronze
0110	1	stuffing box cover		cast iron		nodular cast iron	bronze
0120*	1	impeller	cast iron	bronze	cast iron	bronze	bronze
0130*	1	casing wear ring	cast iron	bronze	cast iron	bronze	bronze
0140	1	bracket support			steel		
0300*	1	gasket			-		
0310	1	plug		cast iron			bronze
0330	1	plug		cast iron			bronze
0340	1	plug		cast iron			bronze
0350	1	plug		cast iron			bronze
0800	**	allen screw		steel			st.st.
0850***	12	allen screw		steel			st.st.
1860	1	impeller key			stainless steel		
1865***	1	impeller key			stainless steel		
2100	1	bearing bracket		cast iron			
2104	1	lantern piece		cast iron			
2108	8	allen screw		steel			
2110	1	bearing cover		cast iron			
2115	1	bearing cover		cast iron			
2120*	1	oil baffle		bronze			
2125*	1	oil baffle		bronze			
2130	1	oil filler cap			aluminium		
2140	1	constant level oiler			—		
2145	1	oil sight glass			—		
2150	1	plug		steel			
2160*	2	gasket			-		
2190	2	adjustment screw			stainless steel		
2200*	1	pump shaft			steel alloy		st.st.
2210*	1	coupling key			steel		
2220*	1	splash ring			rubber		
2250*	1	roller bearing			-		
2260*	2	double row angular contact ball bearing			-		
2300*	1	inner circlip			spring steel		
2330	1	adjustment ring			steel		
2400	1	name plate			stainless steel		
2410	1	arrow plate			aluminium		
2560*	1	shaft nut			steel		
2570*	1	locking ring			steel		
2810	4	allen screw			steel		
2815	4	allen screw			steel		
2820	2	allen screw			steel		
2830	2	washer			steel		

st.st. = stainless steel

** Number dependent on pump type 8, 12 or 16

*** Applies only to CN 125-500 and CN 150-500

9.6 Parts of shaft sealing groups S1-M1

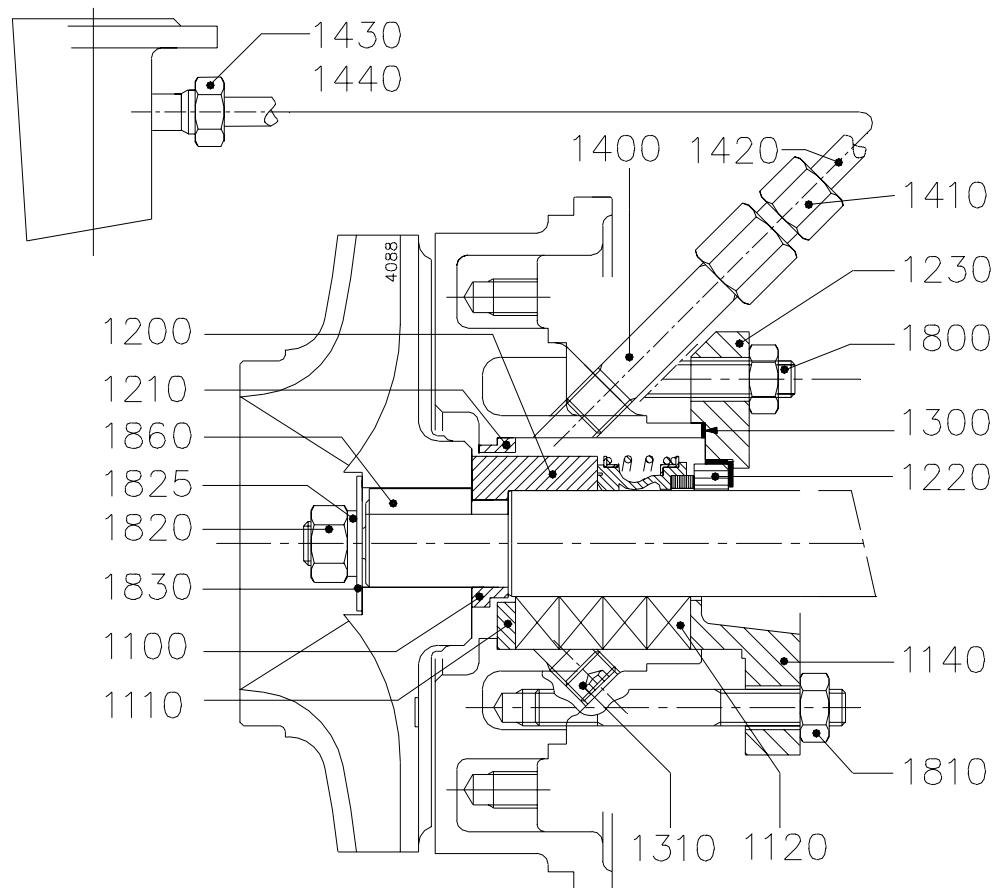


figure 50 Shaft sealing groups S1-M1.

Shaft sealing group S1 (gland packing)

Item	Number	Description	Materials
1100	1	spacer sleeve	steel alloy
1110*	1	bottom ring	brass
1120*	4	packing ring	-
1140	1	gland	cast iron
1310	1	plug	steel
1800	2	stud	stainless steel
1810	2	nut	brass
1820*	1	impeller nut	stainless steel
1825*	1	spring washer	stainless steel
1830*	1	washer	stainless steel
1860*	1	impeller key	stainless steel

Shaft sealing group M1 (mechanical seal)

Item	Number	Description	Materials
1200*	1	shaft sleeve	brass
1210*	1	throttle bush	bronze
1220*	1	mechanical seal	—
1230	1	seal cover	cast iron
1300*	1	gasket	-
1400	1	pipe nipple	steel
1410	1	pipe union	brass
1420	1	pipe	copper
1430	1	pipe union	brass
1440	1	extension piece	stainless steel
1800	4	stud	stainless steel
1810	4	nut	brass
1820*	1	impeller nut	stainless steel
1825*	1	spring washer	stainless steel
1830*	1	washer	stainless steel
1860*	1	impeller key	stainless steel

9.7 Parts shaft sealing groups S1-M1 (CN 200-160 and CN 300-200)

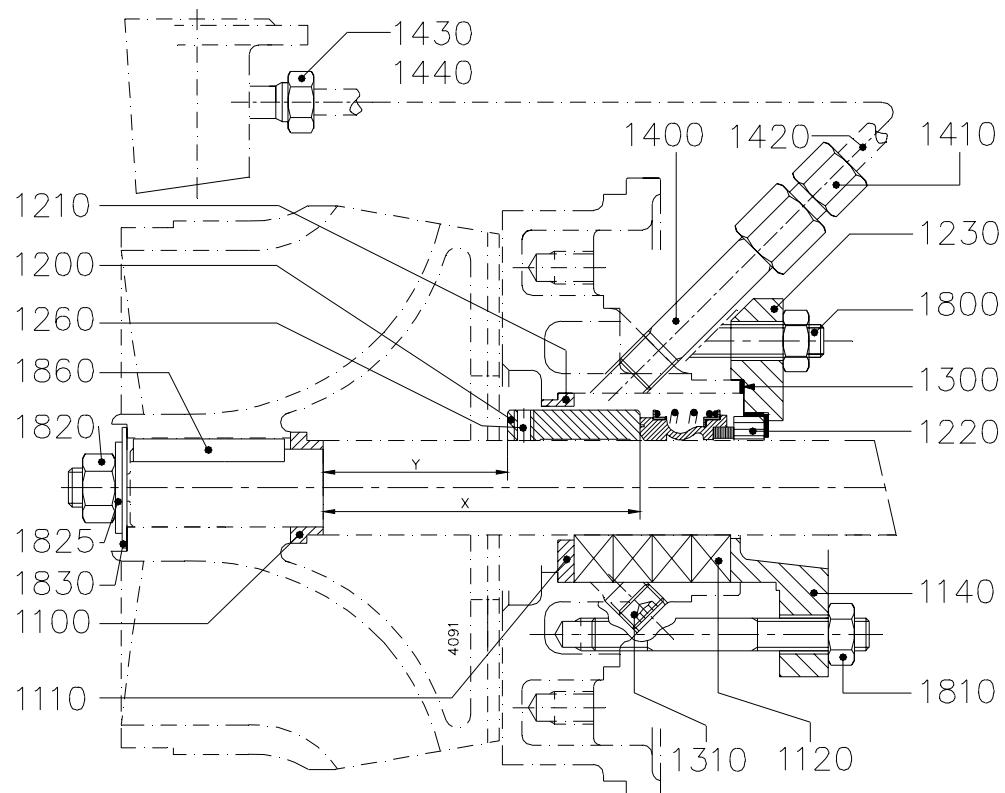


figure 51 Shaft sealing groups S1-M1 (CN 200-160 and CN 300-200).

Shaft sealing group S1 (gland packing) (CN 200-160 and CN 300-200)

Item	Number	Description	Materials
1100	1	spacer sleeve	steel alloy
1110*	1	bottom ring	brass
1120*	4	packing ring	-
1140	1	seal cover	cast iron
1310	1	plug	steel
1800	2	stud	stainless steel
1810	2	nut	brass
1820*	1	impeller nut	stainless steel
1825*	1	spring washer	stainless steel
1830*	1	washer	stainless steel
1860*	1	impeller key	stainless steel

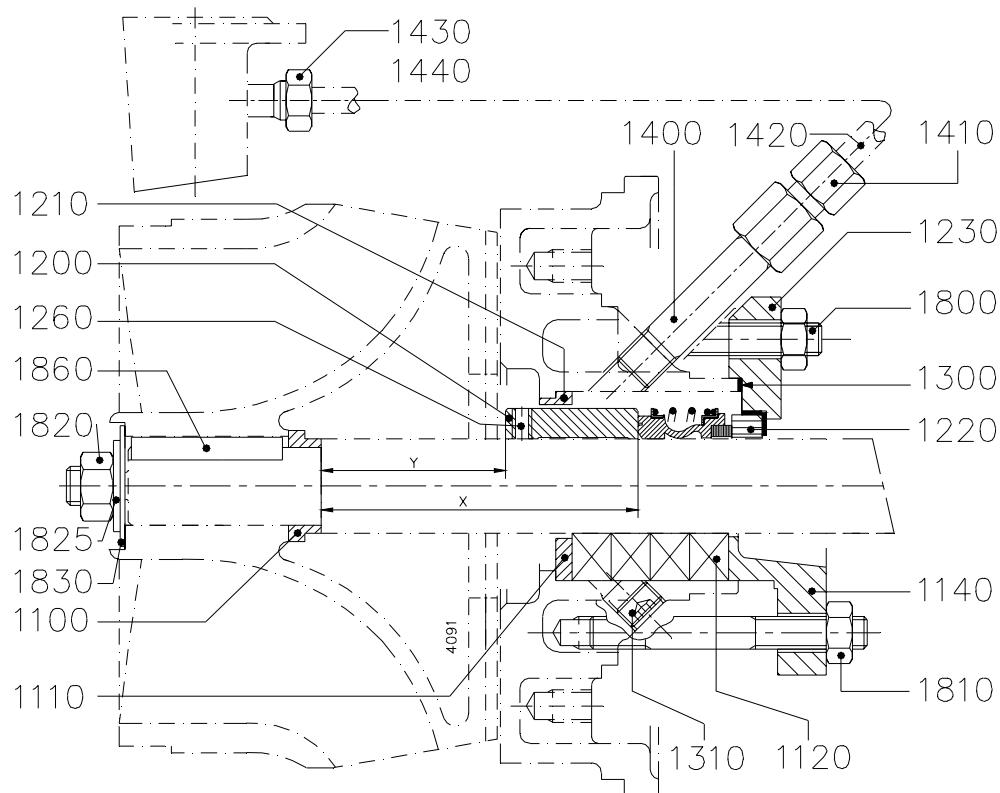


figure 52 Shaft sealing groups S1-M1 (CN 200-160 and CN 300-200).

Shaft sealing group M1 (mechanical seal) (CN 200-160 and CN 300-200)

Item	Number	Description	Materials
1100	1	spacer sleeve	steel alloy
1200*	1	shaft sleeve	brass
1210*	1	throttle bush	bronze
1220*	1	mechanical seal	—
1230	1	seal cover	cast iron
1260*	2	set screw	stainless steel
1300*	1	gasket	-
1400	1	pipe nipple	steel
1410	1	pipe union	brass
1420	1	pipe	copper
1430	1	pipe union	brass
1440	1	extension piece	stainless steel
1800	4	stud	stainless steel
1810	4	nut	brass
1820*	1	impeller nut	stainless steel
1825*	1	spring washer	stainless steel
1830*	1	washer	stainless steel
1860*	1	impeller key	stainless steel

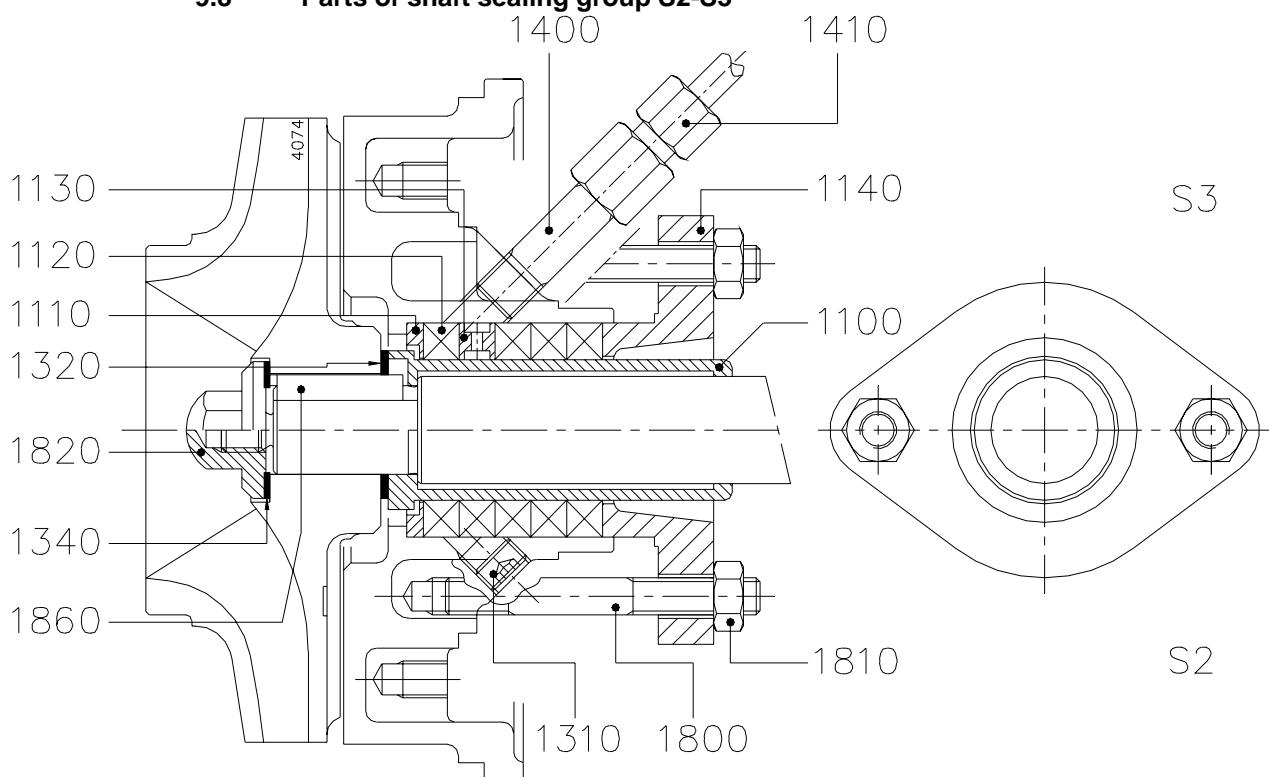
9.8 Parts of shaft sealing group S2-S3


figure 53 Shaft sealing groups S2-S3.

Item	Number		Description	Materials	
	S2	S3		cast iron	bronze
1100*	1	1	shaft sleeve	stainless steel	
1110*	1	1	bottom ring	bronze	
1120*	5	4	packing ring	—	
1130*	-	1	lantern ring	bronze	
1140	1	1	gland	cast iron	bronze
1310	1	-	plug	steel	st.st.
1320*	1	1	gasket	-	
1340*	1	1	gasket	-	
1400	-	1	pipe nipple	steel	st.st.
1410	-	1	pipe union	brass	
1800	2	2	stud	stainless steel	
1810	2	2	nut	brass	st.st.
1820*	1	1	impeller cap nut	bronze	
1860*	1	1	impeller key	stainless steel	

9.9 Parts of shaft sealing groups S2-S3 (CN 200-160 and CN 300-200)

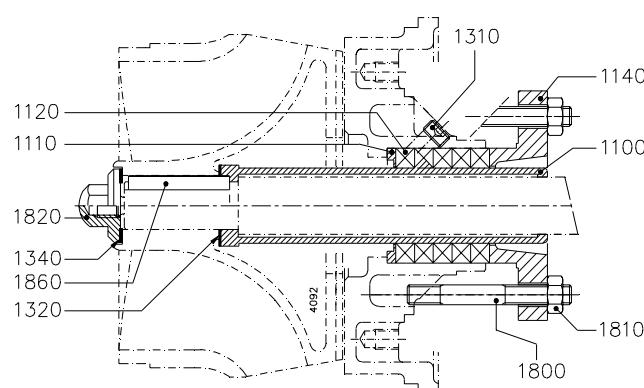


figure 54 Shaft sealing groups S2 (CN 200-160 and CN 300-200).

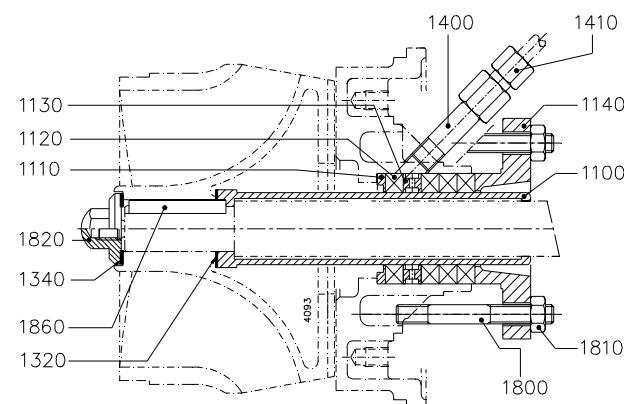


figure 55 Shaft sealing groups S3 (CN 200-160 and CN 300-200).

Item	Number		Description	Materials	
	S2	S3			
1100*	1	1	shaft sleeve	stainless steel	
1110*	1	1	bottom ring	bronze	
1120*	5	4	packing ring	—	
1130*	-	1	lantern ring	bronze	
1140	1	-	gland	cast iron	-
1140	-	1	gland	-	bronze
1310	1	-	plug	steel	
1320*	1	1	gasket	-	
1340*	1	1	gasket	-	
1400	-	1	pipe nipple	stainless steel	
1410	-	1	pipe union	brass	
1800	2	2	stud	stainless steel	
1810	2	2	nut	brass	
1820*	1	1	impeller cap nut	bronze	
1860*	1	1	impeller key	stainless steel	

9.10 Parts of shaft sealing groups S2-S3 for CN bearing group 4

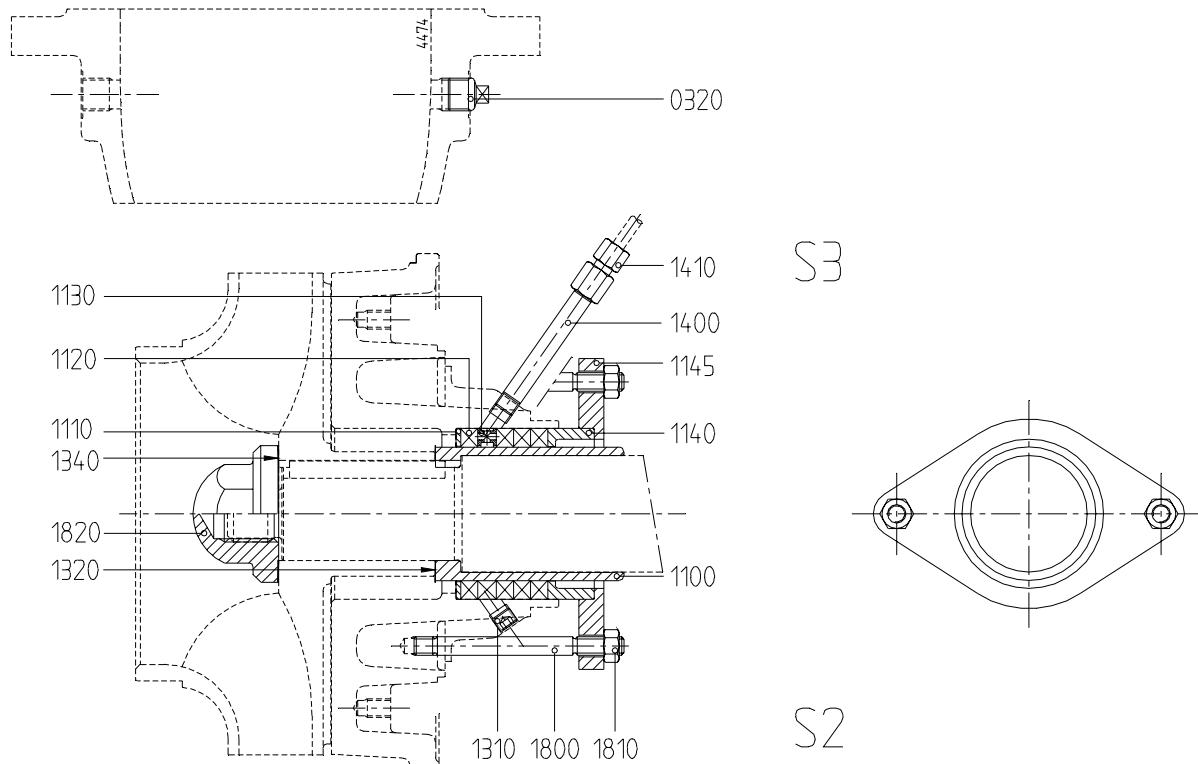


figure 56 Shaft sealing groups S2-S3 for bearing bracket group 4.

Item	Number		Description	Materials	
	S2	S3		cast iron	bronze
0320	1	1	plug	cast iron	bronze
1100*	1	1	shaft sleeve	stainless steel	
1110*	1	1	bottom ring	bronze	
1120*	5	4	packing ring	—	
1130*	-	1	lantern ring	bronze	
1140	1	1	gland bipartite	cast iron	bronze
1145	1	1	gland cap	cast iron	
1310	1	-	plug	steel	stainless steel
1320*	1	1	gasket	-	
1340*	1	1	gasket	-	
1400	-	1	pipe nipple	steel	stainless steel
1410	-	1	pipe union	brass	
1800	2	2	stud	stainless steel	
1810	2	2	nut	brass	stainless steel
1820*	1	1	impeller cap nut	bronze	

9.11 Parts of shaft sealing group S4

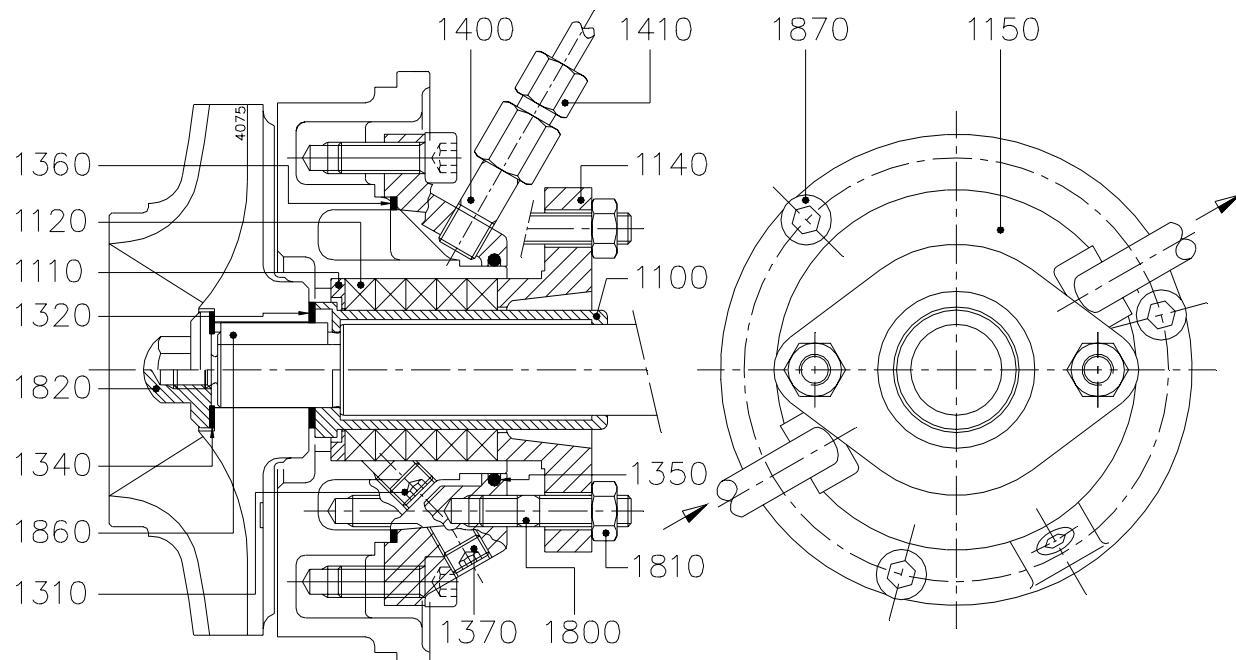


figure 57 Shaft sealing group S4.

Item	Number	Description	Materials
1100*	1	shaft sleeve	stainless steel
1110*	1	bottom ring	bronze
1120*	5	packing ring	-
1140	1	gland	cast iron
1150	1	cooling jacket	cast iron
1310	1	plug	steel
1320*	1	gasket	-
1340*	1	gasket	-
1350*	1	O-ring	rubber
1360*	1	gasket	-
1370	1	plug	steel
1400	2	pipe nipple	steel
1410	2	pipe union	brass
1800	2	stud	stainless steel
1810	2	nut	brass
1820*	1	impeller cap nut	bronze
1860*	1	impeller key	stainless steel
1870	3	allen screw	steel

9.12 Parts of shaft sealing group S4 (CN 200-160 and CN 300-200)

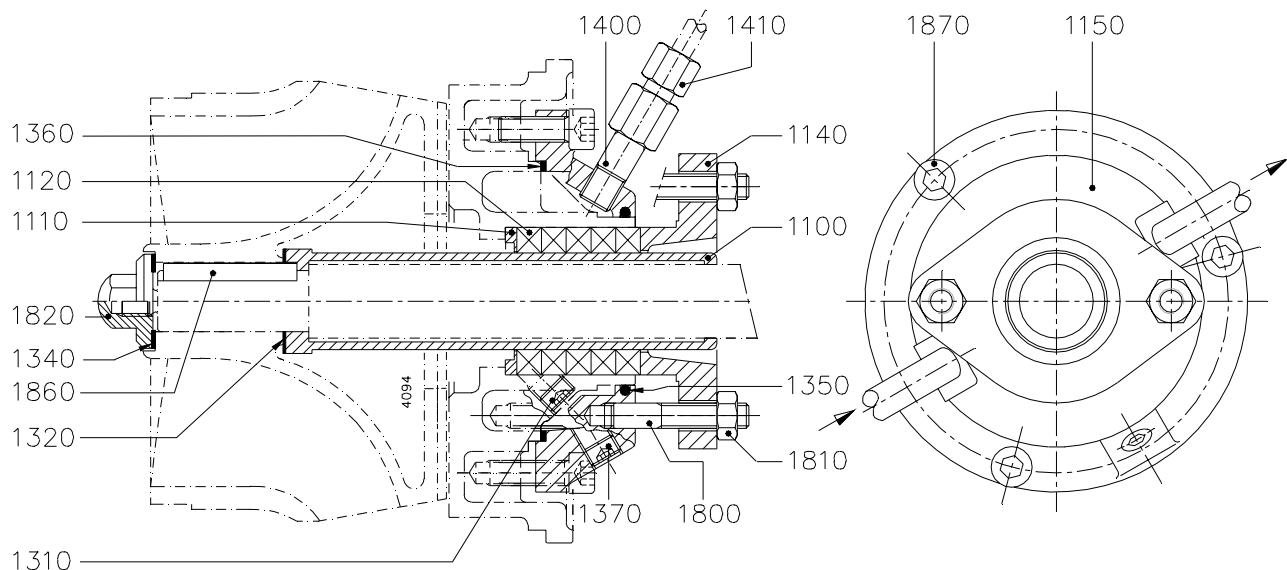


figure 58 Shaft sealing group S4 (CN 200-160 and CN 300-200).

Item	Number	Description	Materials
1100*	1	shaft sleeve	stainless steel
1110*	1	bottom ring	bronze
1120*	5	packing ring	-
1140	1	gland	cast iron
1150	1	cooling jacket	cast iron
1310	1	plug	steel
1320*	1	gasket	-
1340*	1	gasket	-
1350*	1	O-ring	rubber
1360*	1	gasket	-
1370	1	plug	steel
1400	2	pipe nipple	steel
1410	2	pipe union	brass
1800	2	stud	stainless steel
1810	2	nut	brass
1820*	1	impeller cap nut	bronze
1860*	1	impeller key	stainless steel
1870	3	allen screw	steel

9.13 Parts of shaft sealing group S4 for CN bearing group 4

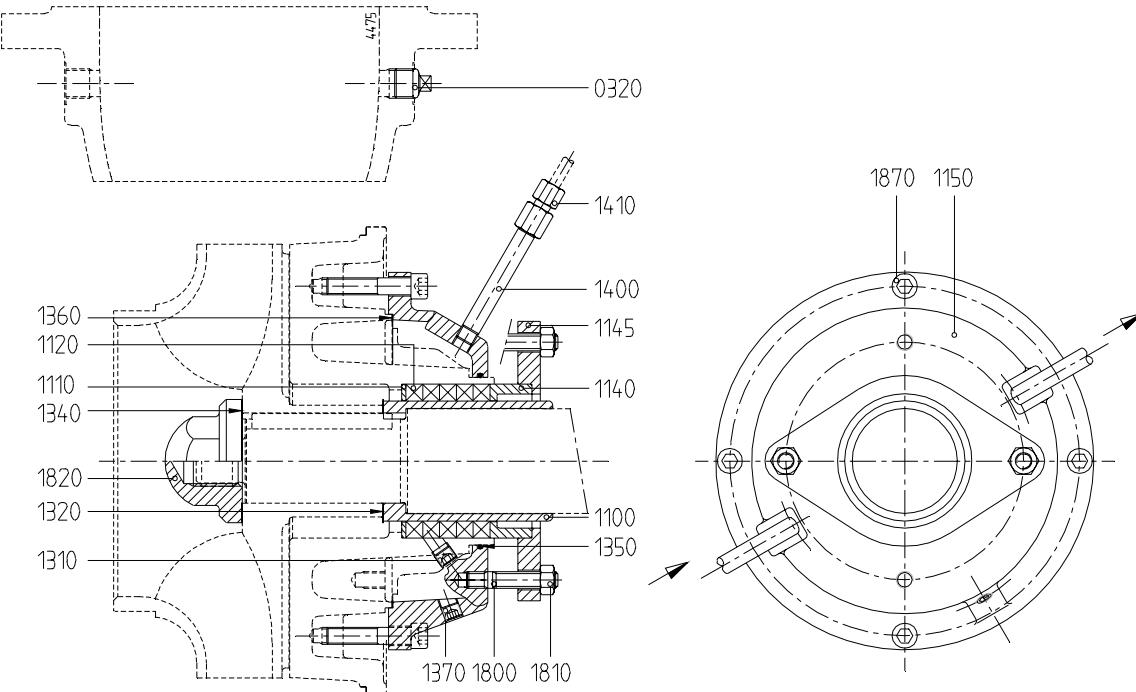


figure 59 Shaft sealing group S4 for bearing bracket group 4.

Item	Number	Description	Materials
0320	1	plug	cast iron
1100*	1	shaft sleeve	stainless steel
1110*	1	bottom ring	bronze
1120*	5	packing ring	-
1140	1	gland bipartite	cast iron
1145	1	gland cap	cast iron
1150	1	cooling jacket	cast iron
1310	1	plug	steel
1320*	1	gasket	-
1340*	1	gasket	-
1350*	1	O-ring	rubber
1360*	1	gasket	-
1370	1	plug	steel
1400	2	pipe nipple	steel
1410	2	pipe union	brass
1800	2	stud	stainless steel
1810	2	nut	brass
1820*	1	impeller cap nut	bronze
1870	4	allen screw	steel

9.14 Parts of shaft sealing groups M2-M3

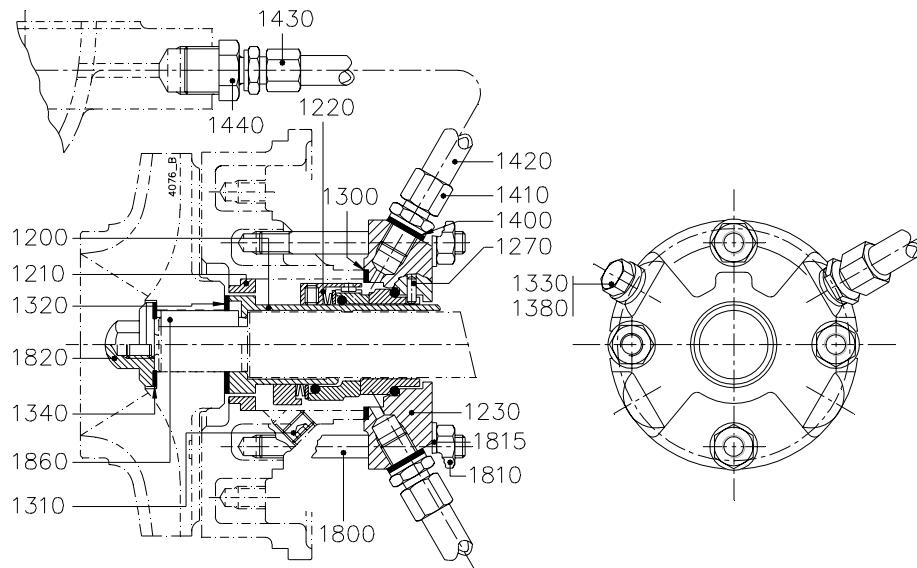


figure 60 Shaft sealing groups M2-M3.

Item	Number		Description	Materials	
	M2	M3		cast iron	bronze
1200*	1	1	shaft sleeve		bronze
1210*	1	1	throttle bush		bronze
1220*	1	1	mechanical seal		-
1230	1	1	seal cover	cast iron	bronze
1270	1	1	lock pin		stainless steel
1300*	1	1	gasket		-
1310	1	1	plug	steel	stainless steel
1320*	1	1	gasket		-
1330	1	1	plug	steel	stainless steel
1340*	1	1	gasket		-
1380	1	1	sealing ring		copper
1400	1	1	sealing ring		copper
1410	1	1	male connector	steel	brass
1420	1	1	pipe	copper	stainless steel
1430	1	1	male connector		brass
1440	1	1	extension piece		stainless steel
1800	4	4	stud		stainless steel
1810	4	4	nut		brass
1815	4	4	washer		steel
1820*	1	1	impeller cap nut		bronze
1860*	1	1	impeller key		stainless steel

9.15 Parts of shaft sealing groups M2-M3 (CN 200-160 and CN 300-200)

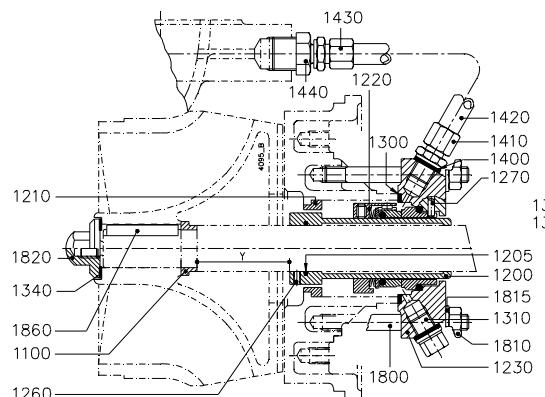


figure 61 Shaft sealing group M2 (CN 200-160 and CN 300-200).

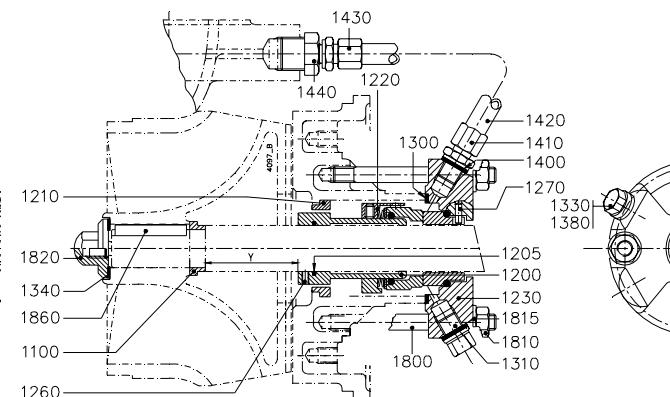


figure 62 Shaft sealing group M3 (CN 200-160 and CN 300-200).

Item	Number		Description	Materials	
	M2	M3		cast iron	bronze
1100	1	1	spacer sleeve		steel alloy
1200*	1	1	shaft sleeve		bronze
1205*	1	1	O-ring		viton
1210*	1	1	throttle bush		bronze
1220*	1	1	mechanical seal		-
1230	1	1	seal cover	cast iron	bronze
1260*	2	2	set screw		stainless steel
1270	1	1	lock pin		stainless steel
1300*	1	1	gasket		-
1310	1	1	plug	steel	stainless steel
1330	1	1	plug	steel	stainless steel
1340*	1	1	gasket		-
1380	1	1	sealing ring		copper
1400	1	1	sealing ring		copper
1410	1	1	male connector		brass
1420	1	1	pipe		stainless steel
1430	1	1	male connector		brass
1440	1	1	extension piece		stainless steel
1800	4	4	stud		stainless steel
1810	4	4	nut		brass
1815	4	4	washer		steel
1820*	1	1	impeller cap nut		bronze
1860*	1	1	impeller key		stainless steel

9.16 Parts of shaft sealing groups M2-M3 for CN bearing group 4

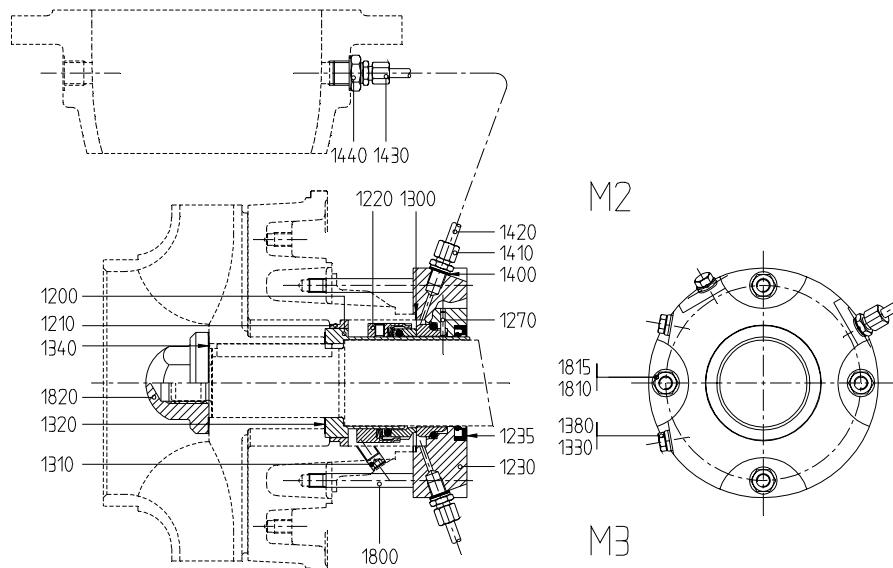


figure 63 Shaft sealing groups M2-M3 for bearing bracket group 4.

Item	Number		Description	Materials	
	M2	M3		cast iron	bronze
1200*	1	1	shaft sleeve		bronze
1210*	1	1	throttle bush		bronze
1220*	1	1	mechanical seal		-
1230	1	1	seal cover	cast iron	bronze
1235	1	1	oil seal		rubber
1270	1	1	lock pin		stainless steel
1300*	1	1	gasket		-
1310	1	1	plug	steel	stainless steel
1320*	1	1	gasket		-
1330	1	1	plug	steel	stainless steel
1340*	1	1	gasket		-
1380	3	3	sealing ring		copper
1400	1	1	sealing ring		copper
1410	1	1	male connector	brass	steel
1420	1	1	pipe		stainless steel
1430	1	1	male connector		brass
1440	1	1	reducing nipple		brass
1800	4	4	stud		stainless steel
1810	4	4	nut	brass	stainless steel
1815	4	4	washer	steel	stainless steel
1820*	1	1	impeller cap nut		bronze

9.17 Parts of shaft sealing groups ML1-ML2

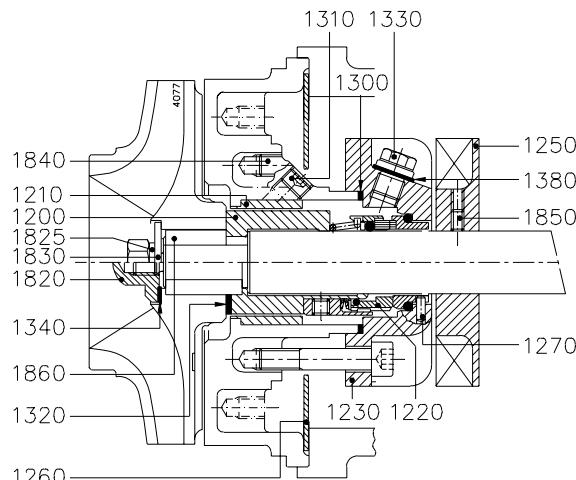


figure 64 Shaft sealing groups ML1-ML2.

Item	Number		Description	Materials
	ML1	ML2		
1200*	1	1	shaft sleeve	steel alloy
1210*	1	1	throttle bush	cast iron
1220*	1	1	mechanical seal	-
1230	1	1	seal cover	copper
1250	1	1	fan	cast iron
1260	1	1	heat shield	packing plate
1270	1	1	lock pin	stainless steel
1300*	1	1	gasket	-
1310	1	1	plug	steel
1320*	-	1	gasket	-
1330	1	1	plug	steel
1340*	-	1	gasket	-
1380	1	1	sealing ring	copper
1820*	1	-	impeller nut	stainless steel
1820*	-	1	impeller cap nut	bronze
1825*	1	-	spring washer	stainless steel
1830*	1	-	washer	stainless steel
1840	2	2	allen screw	steel
1850	2	2	lock screw	stainless steel
1860*	1	1	impeller key	stainless steel

10 Technical data

10.1 Lubricants

10.1.1 Oil

Recommended oils according to ISO VG 68 classification for ambient temperatures above 15°C:

BP	HLP 68
CHEVRON	EP industrial oil 68
ESSO	Teresso 68
TOTAL	Azolla 68
TEXACO	Rando Oil HDC 68
SHELL	Tellus 68
MOBIL	Mobil D.T.E. Oil Heavy Medium

10.1.2 Oil contents

Bearing bracket	Contents
1	0,4 dm ³
2	0,5 dm ³
3	0,6 dm ³
4	1,5 dm ³

10.1.3 Grease

Recommended greases according to NLGI-2 classification:

BP	Energrease LS 2
SHELL	Alvania R2
MOBIL	Mobilux EP 2
TOTAL	Multis EP-22
CHEVRON	Polyurea EP Grease-2
ESSO	Beacon 2
FINA	Marson L2
TEXACO	MultifaK EP-2
SKF	Alfalub LGMT 3

10.2 Media for assembling

10.2.1 Recommended mounting grease

Recommended greases for greasing stuffing box packing rings:

- Foliac Cup grease (graphite grease)
- MolyCote BR2 (graphite grease)
- silicon grease

10.2.2 Recommended locking liquid

Part	Locking liquid
impeller nut	Loctite 243
throttling bush	Loctite 641
casing wear ring	
throttling bush ML1 and ML2	Loctite 648 'Heat Resistant Retainer'
casing wear ring ML1 and ML2	

10.3 Tightening moments

10.3.1 Tightening moments for bolts and nuts

Thread	Tightening moment [Nm]	
Material	8.8	A2, A4
M6	9	6
M8	20	14
M10	40	25
M12	69	43
M16	168	105
M20	324	180

10.3.2 Tightening moments for impeller nuts

Size	Tightening moment [Nm]
M12 (bearing bracket 1)	43
M16 (bearing bracket 2)	105
M24 (bearing bracket 3)	220
M36 (bearing bracket 4)	510

10.4 Max. allowable working pressure

Max. allowable working pressure [bar] (based on ISO 7005-2/3)

Material	Temperature [°C]				
	50	120	150	180	200
Cast iron G1-G2*	10 16	10 16	9 14,4	8,4 13,4	8 12,8
Nodular cast iron NG1 NG2	16	16	15,5	15	14,7
Bronze B2**	10 13	10 13	10 13	10 13	- -

Test pressure: 1,3 x max. working pressure.

Shaft sealing group	Max. allowable working pressure [bar]	Max. temperature [°C]
S1	10	105
S2	16	105
S3	10	105
S4	16	160
M1	10	110
M2	10	160***
M3	16	160***
ML1****	8	150
ML2****	16	160

* Selection based on value S2/M3 and S4 G1-G2, see table in 10.7.

** Selection based on value S2/M3 B2, see table in 10.7.

*** Higher temperatures in consultation. All this dependent on the liquid to be pumped.

**** Ask our advise for pump selection.

10.5 Pressure in shaft sealing compartment for types M1 - M2 - M3

Pressure in shaft sealing compartment above the pressure on suction side in case of external circulation from pressure side, calculated for a specific mass of 1000 kg/m³

CN	n[min ⁻¹]/[bar]									
	900	1200	1500	1800	2100	2400	2700	3000	3300	3600
32-125	0,2	0,3	0,5	0,7	0,9	1,2	1,5	1,8	2,2	2,6
32-160	0,3	0,4	0,7	1,0	1,3	1,7	2,2	2,6	3,2	3,8
32-200	0,3	0,6	0,9	1,3	1,8	2,4	3,0	3,7	4,5	5,4
32-250	0,5	1,0	1,5	2,1	2,9	3,8	4,8	5,9		
40-125	0,2	0,3	0,5	0,7	1,0	1,2	1,5	1,9	2,3	2,7
40-160	0,2	0,4	0,7	0,9	1,3	1,7	2,1	2,6	3,2	3,8
40-200	0,4	0,7	1,1	1,6	2,2	2,9	3,6	4,5	5,4	6,5
40-250	0,6	1,0	1,6	2,2	3,0	4,0	5,0	6,2		
40-315	0,8	1,4	2,1	3,1	4,2	5,4				
50-125	0,2	0,3	0,5	0,7	0,9	1,2	1,5	1,8	2,2	2,6
50-160	0,2	0,4	0,7	1,0	1,3	1,7	2,1	2,7	3,2	3,8
50-200	0,4	0,7	1,0	1,5	2,0	2,6	3,3	4,1	4,9	5,8
50-250	0,6	1,1	1,7	2,4	3,3	4,3	5,4	6,7		
50-315	0,8	1,4	2,2	3,2	4,3	5,6				
65-125	0,2	0,3	0,5	0,7	0,9	1,2	1,5	1,9	2,3	2,7
65-160	0,3	0,5	0,7	1,0	1,4	1,8	2,3	2,8	3,4	4,1
65-200	0,4	0,7	1,0	1,5	2,0	2,6	3,3	4,1	5,0	6,0
65-250	0,5	0,9	1,5	2,1	2,9	3,7	4,7	5,8		
65-315	0,9	1,6	2,4	3,5	4,7	6,1				
80-160	0,3	0,5	0,8	1,1	1,5	1,9	2,4	3,0	3,6	4,3
80-200	0,3	0,6	0,9	1,3	1,8	2,3	2,9	3,5	4,3	5,1
80-250	0,6	1,0	1,6	2,3	3,1	4,1	5,2	6,4	7,7	
80-315	0,8	1,4	2,1	3,1	4,2	5,5				
80-400	1,1	1,9	3,0	4,3	5,9	7,6	9,7			
100-125	0,2	0,4	0,6	0,9	1,2	1,6	2,0	2,4	2,9	3,5
100-160	0,3	0,5	0,8	1,1	1,5	1,9	2,4	3,0	3,6	4,3
100-200	0,4	0,7	1,0	1,5	2,0	2,6	3,3	4,1		
100-250	0,5	1,0	1,5	2,2	3,0	3,9	4,9	6,0		
100-315	0,8	1,4	2,2	3,2	4,4	5,7				
100-400	1,2	2,2	3,4	4,9	6,6	8,6	9,3			
125-125	0,2	0,4	0,6	0,8	1,1	1,5	1,9			
125-250	0,5	1,0	1,5	2,2	3,0	3,5	4,0	4,4		
125-315	0,8	1,4	2,2	3,1	4,2	5,5	5,6	5,1		
125-400	1,2	2,1	3,2	4,7	5,4	6,3	7,1			
125-500	1,6	2,8	4,4	6,3	7,0	7,2	6,4			

CN	n[min ⁻¹]/[bar]									
	900	1200	1500	1800	2100	2400	2700	3000	3300	3600
150-125	0,2	0,4	0,7	0,9	1,3	1,7				
150-160	0,3	0,5	0,8	1,2	1,6	2,0	2,0			
150-200	0,4	0,7	1,0	1,5	2,0	2,6	3,3			
150-250	0,5	0,8	1,3	1,9	2,6	3,4				
150-315	0,8	1,4	2,2	3,2	3,0					
150-400	1,3	2,3	3,6	4,2	5,0					
150B-400	1,0	1,8	2,8	4,1	4,8	5,1	5,1			
150-500	1,6	2,9	4,5	5,0						
200-160	0,3	0,5	0,8	1,0						
200-200	0,5	0,8	1,3	1,6						
200-250	0,5	0,8	1,3	1,9	2,5	2,7	3,4	3,4		
200-315	0,6	1,0	1,6	2,3	3,1	4,1	5,2	4,0		
200-400	1,0	1,8	2,8	4,0	4,5	3,7				
250-200	0,5	0,5	1,3	1,8	2,0					
250-250	0,5	0,9	1,4	2,0						
250-315	0,6	1,1	1,7	2,5	3,4	3,7				
300-200	0,5	0,5	1,3							
300-250	0,6	1,0	1,7							
300-315	0,6	1,1	1,8							

10.6 Pressure at the impeller hub for types S1 - S2 - S3 - S4

Pressure at the impeller hub above the pressure on suction side in case of external circulation from pressure side, calculated for a specific mass of 1000 kg/m³.

CN	n[min ⁻¹]/[bar]									
	900	1200	1500	1800	2100	2400	2700	3000	3300	3600
32-125	0,1	0,1	0,2	0,3	0,4	0,6	0,7	0,9	1,1	1,3
32-160	0,1	0,2	0,4	0,6	0,8	1,0	1,2	1,5	1,9	2,2
32-200	0,1	0,2	0,4	0,5	0,7	0,9	1,2	1,4	1,7	2,1
32-250	0,2	0,4	0,6	0,8	1,2	1,5	1,9	2,4		
40-125	0,1	0,2	0,3	0,4	0,5	0,7	0,8	1,0	1,2	1,5
40-160	0,1	0,1	0,2	0,3	0,4	0,6	0,7	0,9	1,1	1,3
40-200	0,2	0,4	0,6	0,9	1,3	1,6	2,1	2,5	3,1	3,7
40-250	0,3	0,4	0,7	1,0	1,4	1,8	2,3	2,8		
40-315	0,4	0,7	1,1	1,6	2,1	2,8				
50-125	0,0	0,1	0,1	0,2	0,2	0,3	0,4	0,5	0,5	0,6
50-160	0,1	0,2	0,2	0,4	0,5	0,6	0,8	1,0	1,2	1,4
50-200	0,1	0,2	0,3	0,5	0,6	0,8	1,0	1,3	1,5	1,8
50-250	0,3	0,4	0,7	1,0	1,4	1,8	2,3	2,8		
50-315	0,3	0,6	0,9	1,3	1,7	2,2				
65-125	0,0	0,0	0,0	0,0	0,0	0,0	0,1	0,1	0,1	0,1
65-160	0,0	0,1	0,1	0,1	0,2	0,2	0,3	0,4	0,4	0,5
65-200	0,1	0,2	0,3	0,5	0,6	0,8	1,0	1,3	1,5	1,8
65-250	0,2	0,3	0,5	0,7	1,0	1,3	1,6	2,0		
65-315	0,4	0,7	1,1	1,6	2,2	2,9	0,0	0,0		
80-160	0,0	0,0	0,0	0,0	0,0	0,0	0,2	0,3	0,0	0,0
80-200	0,0	0,0	0,1	0,1	0,1	0,2	1,3	1,6	0,4	0,4
80-250	0,1	0,3	0,4	0,6	0,8	1,0			1,9	
80-315	0,2	0,4	0,6	0,9	1,2	1,6	3,3			
80-400	0,4	0,6	1,0	1,4	2,0	2,6	0,0	0,0		
100-125	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
100-160	0,0	0,0	0,0	0,0	0,0	0,0	0,4	0,4	0,0	0,0
100-200	0,0	0,1	0,1	0,2	0,2	0,3	0,7	0,8		
100-250	0,1	0,1	0,2	0,3	0,4	0,5				
100-315	0,2	0,4	0,7	0,9	1,3	1,7	5,6			
100-400	0,6	1,1	1,7	2,5	3,4	4,4	0,0			
125-125	0,0	0,0	0,0	0,0	0,0	0,0	0,7	0,9		
125-250	0,1	0,1	0,2	0,3	0,4	0,6	1,8	2,2		
125-315	0,2	0,4	0,6	0,8	1,1	1,4	3,6			
125-400	0,4	0,7	1,1	1,6	2,2	2,8	1,3			
125-500	0,9	1,5	2,4	3,4	3,4	2,8				

CN	n[min⁻¹]/[bar]									
	900	1200	1500	1800	2100	2400	2700	3000	3300	3600
150-125	0,0	0,0	0,0	0,0	0,0	0,0	0,1			
150-160	0,0	0,0	0,0	0,0	0,1	0,1	0,0			
150-200	0,0	0,0	0,0	0,0	0,0	0,0				
150-250	0,0	0,0	0,0	0,0	0,0	0,0				
150-315	0,1	0,2	0,4	0,5	0,7					
150-400	0,4	0,6	1,0	1,4	1,9		0,2			
150B-400	0,4	0,7	1,1	1,6	1,6	1,1				
150-500	0,8	1,5	2,3	2,0						
200-160	0,0	0,0	0,1	0,1						
200-200	0,0	0,0	0,0	0,1			0,5	0,0		
200-250	0,1	0,2	0,4	0,5	0,7	0,4	1,5	0,0		
200-315	0,2	0,3	0,5	0,6	0,9	1,2				
200-400	0,4	0,7	1,0	1,5	1,2	0,0				
250-200	0,0	0,1	0,1	0,1	0,2					
250-250	0,1	0,2	0,4	0,5						
250-315	0,1	0,2	0,4	0,5	0,7	0,3				
300-200	0,1	0,2	0,2							
300-250	0,1	0,2	0,3							
300-315	0,1	0,1	0,2							

10.7 Maximum working pressure

CN	Max. speed *		Available shaft sealing groups and maximum working pressure [bar] at 50°C dependent on the material variant.											
			G1 - G2						NG1 - NG2				B2	
	L1 L3	L2 L4	S1 M1	S2 M3	S3 M2	S4	ML1	ML2	S2 M3	S3 M2	S4	ML2	S2 M3	S3 M2
32-125	3600		10	16	10	-	-	-	-	-	-	-	13	10
32-160	3600		10	16	10	16	8	10	16	10	16	16	13	10
32-200	3600		10	16	10	16	8	10	16	10	16	16	13	10
32-250	3000		10	16	10	16	8	10	16	10	16	16	13	10
40-125	3600		10	16	10	-	-	-	-	-	-	-	13	10
40-160	3600		10	16	10	16	8	10	16	10	16	16	13	10
40-200	3600		10	16	10	16	8	10	16	10	16	16	13	10
40-250	3000		10	16	10	16	8	10	16	10	16	16	13	10
40-315	2400		10	16	10	16	8	10	16	10	16	16	13	10
50-125	3600		10	10	10	-	-	-	-	-	-	-	10	10
50-160	3600		10	10	10	10	8	10	16	10	16	16	10	10
50-200	3600		10	10	10	10	8	10	16	10	16	16	10	10
50-250	3000		10	10	10	10	8	10	16	10	16	16	10	10
50-315	2400		10	16	10	16	8	10	16	10	16	16	13	10
65-125	3600		10	10	10	-	-	-	-	-	-	-	10	10
65-160	3600		10	10	10	10	8	10	16	10	16	16	10	10
65-200	3600		10	10	10	10	8	10	16	10	16	16	10	10
65-250	3000		10	10	10	10	8	10	16	10	16	16	10	10
65-315	2400		10	10	10	10	8	10	16	10	16	16	10	10
80-160	2700	3600	10	10	10	10	8	10	16	10	16	16	10	10
80-200	3600		10	10	10	10	8	10	16	10	16	16	10	10
80-250	3300		10	10	10	10	8	10	16	10	16	16	10	10
80-315	2400		10	10	10	10	8	10	16	10	16	16	10	10
80-400	2200	2700	10	16	10	16	-	-	16	10	16	-	13	10
100-125	3600	3600	10	10	10	10	8	10	16	10	16	16	10	10
100-160	3300		10	10	10	10	8	10	16	10	16	16	10	10
100-200	3000	3000	10	16	10	16	8	10	16	10	16	16	13	10
100-250	2400	3000	10	16	10	16	8	10	16	10	16	16	13	10
100-315	2400	2400	10	16	10	16	8	10	16	10	16	16	13	10
100-400	2400		10	16	10	16	-	-	16	10	16	-	13	10
125-125	2400	2700	10	10	10	10	8	10	16	10	16	16	10	10
125-250	1800	1800	10	16	10	16	8	10	16	10	16	16	13	10
125-315	2300	2400	10	16	10	16	-	-	16	10	16	16	13	10
125-400	1800	1800	10	16	10	16	-	-	16	10	16	-	13	10
125-500	1500	-	10	10	10	-	-	-	16	10	16	-	10	10
150-125	1800	2400	10	10	10	10	8	10	16	10	16	16	10	10
150-160	2400	2500	10	10	10	10	8	10	16	10	16	16	10	10
150-200	2700	2700	10	10	10	10	8	10	16	10	16	16	10	10
150-250	2100	2200	10	10	10	10	-	-	16	10	16	-	10	10
150-315	1480	1480	10	10	10	10	-	-	16	10	16	-	10	10
150-400	1480		10	10	10	10	-	-	16	10	16	-	10	10
150B-400		1800	-	10	10	10	-	-	16	10	16	-	10	10
150-500	1500	-	10	10	10	10	-	-	16	10	16	-	10	10
200-160	1500	1500	10	-	-	-	-	-	-	-	-	-	-	-
200-200	1780	1800	10	10	10	10	8	10	16	10	16	16	10	10
200-250		2400	-	10	10	10	-	-	16	10	16	-	10	10
200-315		2400	-	10	10	10	-	-	16	10	16	-	10	10
200-400		1700	-	10	10	10	-	-	16	10	16	-	10	10
250-200	1500	1800	10	10	10	10	-	-	16	10	16	-	10	10
250-250		1900	-	10	10	10	-	-	16	10	16	-	10	10
250-315		2000	-	10	10	10	-	-	16	10	16	-	10	10
300-200		1500	10	-	-	-	-	-	-	-	-	-	-	-
300-250		1500	-	10	10	10	-	-	16	10	16	-	10	10
300-315		1500	-	10	10	10	-	-	16	10	16	-	10	10

* = With maximum impeller diameter, see also 10.8

10.8 Higher maximum speed

Eventual higher maximum speed as mentioned in 10.7, with reduced impeller diameter:

D_{max} = maximum impeller diameter

D_{min} = eventual minimum impeller diameter

Bearings L1-L3

CN		max. speed [min ⁻¹] / impeller diameter [mm]															
		1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	2500	2600	2700	2800	2900	3000
80-400	D _{max}	410							410	405	400	395	385	380			
100-400	D _{max}	410								410	400	390	380				
125-315	D _{max}	324								324	315	305	295	286	275	260	250
125-400	D _{max}	404		404	395	385	375	366	357	352							
	D _{min}						325	337	342	348							
150-160	D _{max}	200									200	190					
150-200	D _{max}	224											224	212			
150-250	D _{max}	273					273	273									
	D _{min}						252	273									
150-315	D _{max}	318	305	295	285	277	270										
150-400	D _{max}	408	395	383	345	340	335	330	325	319	315						
200-160	D _{max}	205	201	195													
200-200	D _{max}	244		244	235	228	222										
250-200	D _{max}	252															

Bearings L2-L4

CN		max. speed [min ⁻¹] / impeller diameter [mm]															
		1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	2500	2600	2700	2800	2900	3000
80-400	D _{max}	410												410			
100-400	D _{max}	410									410	400	390	380			
125-315	D _{max}	324									324	317	305	290	275	260	250
125-400	D _{max}	404		404	395	385	375	366	357	353	345	337	332				
	D _{min}											320	325				
125-500	D _{max}	530	509	480	455	432	400										
150-160	D _{max}	200										200	188	176			
150-200	D _{max}	224											224	212			
150-250	D _{max}	273							273	254	244						
150-315	D _{max}	320	315	295	285	277	270	265	258	250							
150-400	D _{max}	408	395	385	372	362	352	345									
150B-400	D _{max}	430			430	421	399	380	362								
150-500	D _{max}	525	503	475	451												
200-160	D _{max}	205	201	195	189	185	181										
200-200	D _{max}	244			235	228	222										
200-250	D _{max}	310									310						
200-315	D _{max}	345									345						
200-400	D _{max}	438		438	432	419	408	388	368								
250-200	D _{max}	252			252	244	236	230									
250-250	D _{max}	310				310											
250-315	D _{max}	368					368	366	356	347	339						
300-250	D _{max}	345	336	324													
300-315	D _{max}	365	330														

10.9 Survey curves

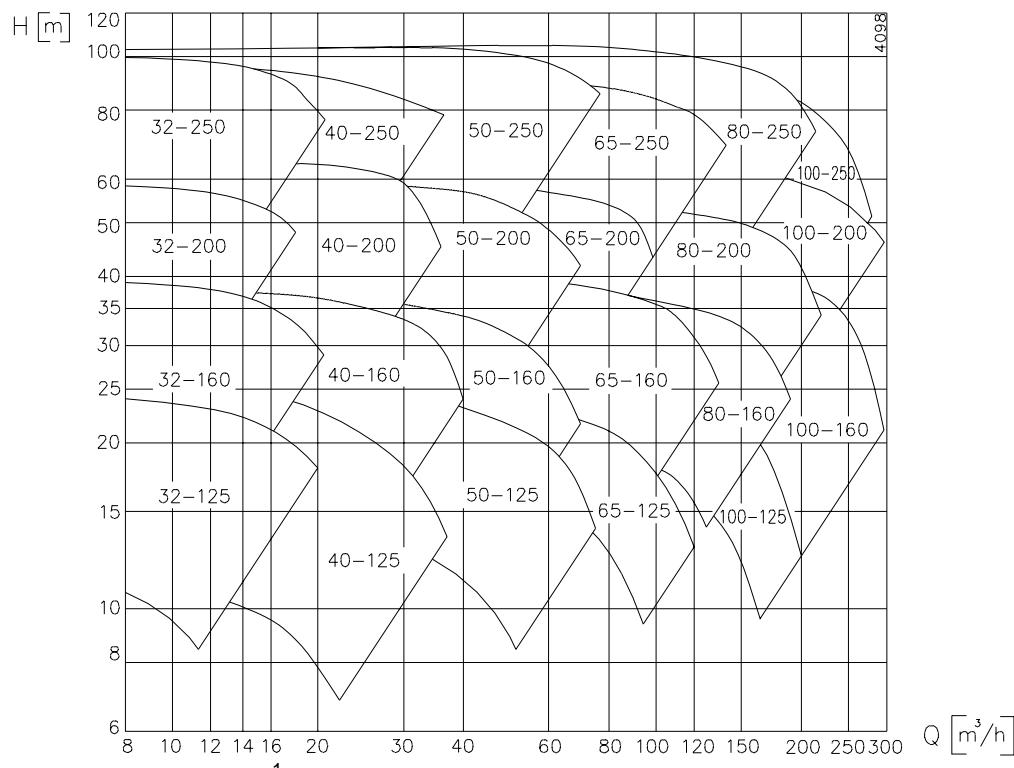


figure 65 Survey curve 3000 min^{-1} .

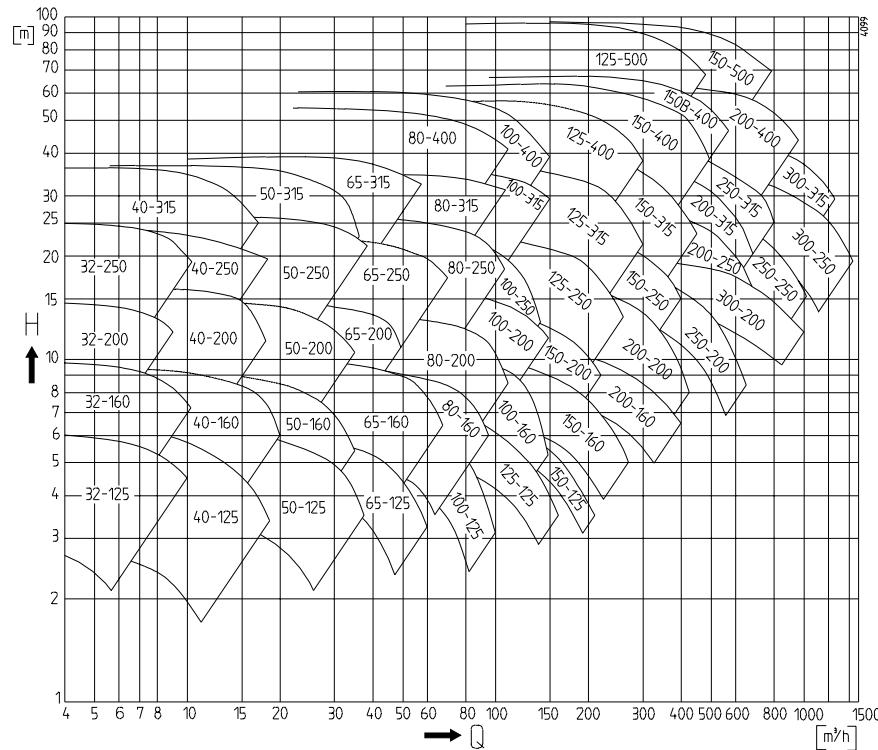
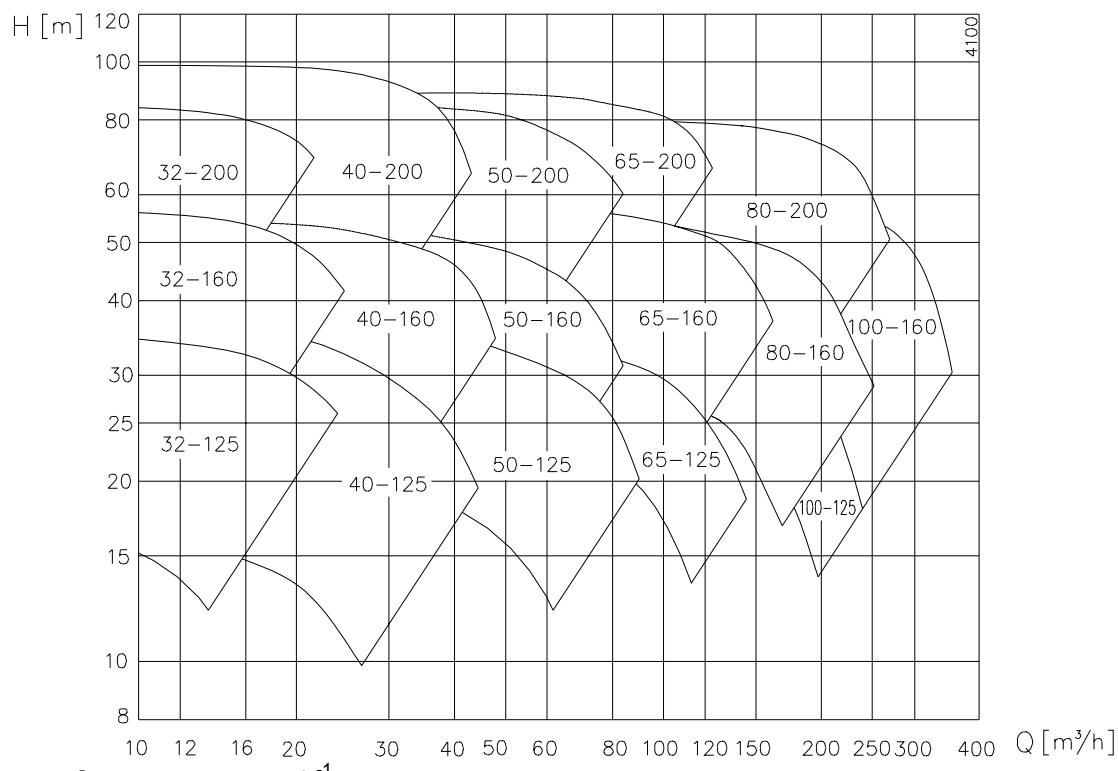
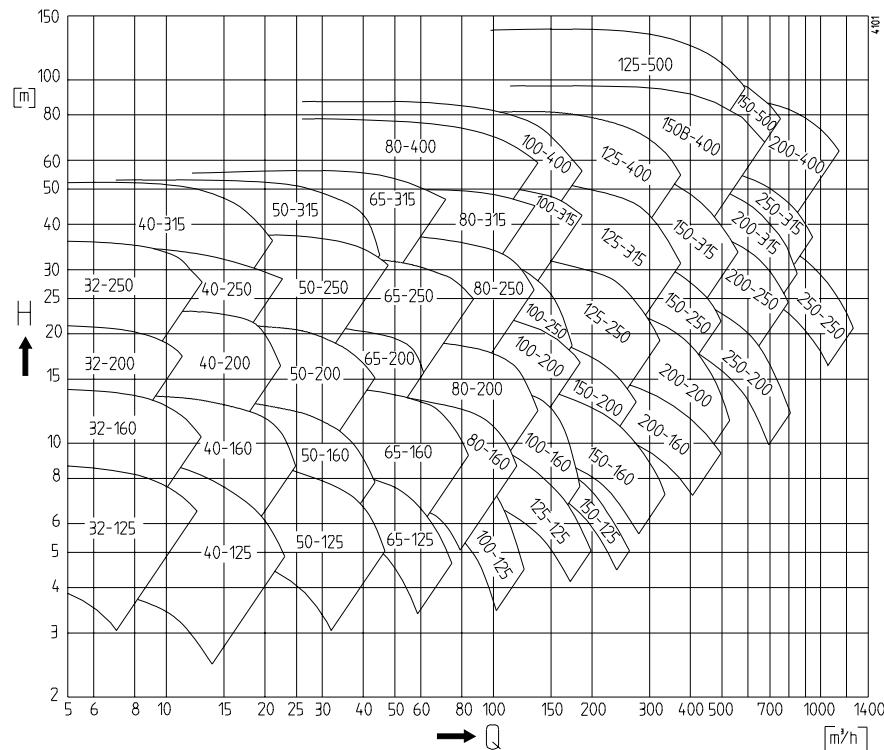


figure 66 Survey curve 1500 min^{-1} .

figure 67 Survey curve 3600 min^{-1} .figure 68 Survey curve 1800 min^{-1} .

10.10 Permitted forces and torques on the flanges

The forces and torques acting on the flanges cause deformations in the pump unit. These are manifested in a displacement of the shaft journal of the pump in relation to the shaft journal of the motor.

The permissible forces and torques on the flanges should be based on the following maximum values for the radial displacement of the shaft journal of the pump:

- pumps of bracket group 1: 0,15 mm.
- pumps of bracket group 2: 0,20 mm.
- pumps of bracket group 3: 0,25 mm.
- pumps of bracket group 4: 0,30 mm.

Irrespective of the direction of the forces and torques and their components on the flanges, the permissible values should comply with the following equation:

$$\left(\frac{F_v}{F_{v\max}}\right)^2 + \left(\frac{F_h}{F_{h\max}}\right)^2 + \left(\frac{M}{M_{\max}}\right)^2 \leq 1$$

$$F_v = \frac{2}{3} F_{v\text{press.}} + F_{v\text{suct.}} \leq F_{v\max}$$

index v = in vertical direction, y axis

$$F_h = F_{h\text{press.}} + \frac{2}{3} F_{h\text{suct.}} \leq F_{h\max}$$

index h = in horizontal direction, x axis and z axis

$$M = M_{\text{press.}} + M_{\text{suct.}} \leq M_{\max}$$

M = torque in the plane of the flange

$F_{v\max}$, $F_{h\max}$ and M_{\max} are given in the table. A distinction is made here between a pump unit with a base plate **not grouted** and a pump unit with a base plate which **is grouted**.

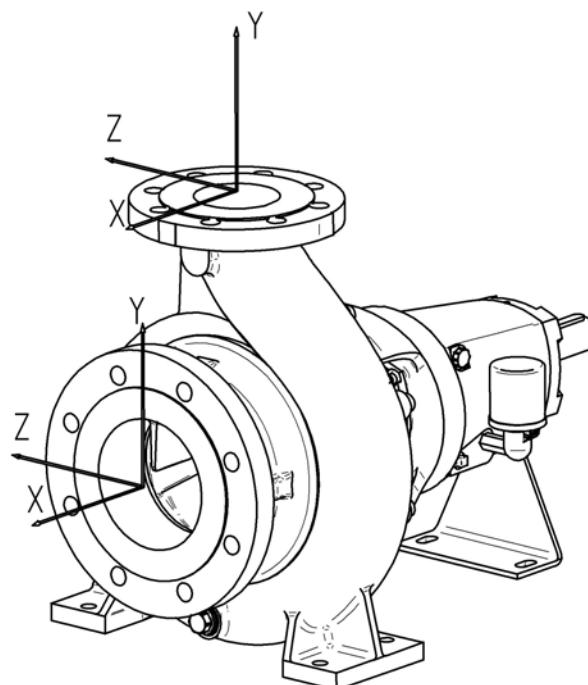


figure 69 Coordinate system.

10.10.1 Permissible forces and moments on the flanges - bearing groups 1, 2, 3

Permitted forces and torques on the flanges, based on ISO 5199. See figure 69

CN	Bracket group	Pump unit, non grouted base plate			Pump unit, grouted base plate		
		F _{vmax} [N]	F _{hmax} [N]	M _{max} [Nm]	F _{vmax} [N]	F _{hmax} [N]	M _{max} [Nm]
32-125	1	1250	950	175	2250	1500	450
32-160	1	1250	950	150	2250	1500	425
32-200	1	1250	950	150	2250	1500	425
32-250	1	1250	950	140	2200	1450	400
40-125	1	1450	1050	250	2550	1800	625
40-160	1	1300	975	200	2300	1600	500
40-200	1	1300	975	200	2300	1600	500
40-250	1	1250	950	180	2250	1550	475
40-315	2	1400	1000	275	2500	1750	650
50-125	1	1450	1050	250	2550	1800	625
50-160	1	1450	1050	250	2600	1900	625
50-200	1	1400	1000	275	2500	1750	650
50-250	1	1300	1000	225	2450	1750	600
50-315	2	1500	1050	300	2750	2000	800
65-125	1	1850	1250	475	3250	2500	1200
65-160	1	1500	1050	325	2800	2100	850
65-200	1	1550	1100	350	2900	2200	900
65-250	2	1750	1200	450	3200	2400	1125
65-315	2	1500	1050	325	2800	2100	850
80-160	1	1650	1050	400	3000	2300	1000
80-200	2	1950	1250	500	3400	2550	1225
80-250	2	2250	1450	625	3750	2950	1500
80-315	2	2000	1300	500	3450	2600	1250
80-400	3	2500	1500	750	4100	3250	1750
100-125	1	2200	1400	625	3800	3000	1550
100-160	2	2900	1750	875	4500	3650	2050
100-200	2	3100	1850	900	4750	3900	2175
100-250	2	2600	1550	800	4200	3400	1850
100-315	2	2450	1450	700	4000	3200	1700
100-400	3	2800	1650	875	4450	3550	1950
125-125	1	2750	1600	850	4400	3600	1900
125-250	2	3950	2400	1300	5550	4800	2800
125-315	3	4100	2550	1400	5750	5000	2950
125-400	3	4000	2500	1375	5700	4900	2875
150-125	1	3000	1800	900	4600	3750	2100
150-160	2	3500	2450	1350	5600	4800	2850
150-200	2	3500	2450	1350	5600	4800	2850
150-250	3	4600	3000	1600	6200	5700	3300
150-315	3	4600	3000	1600	6200	5700	3300
150-400	3	4600	3000	1600	6200	5700	3300
200-160	2V	4000	2500	1375	5700	4900	2875
200-200	2	4000	2500	1375	5700	4900	2875
250-200	3	4900	3250	1800	6500	6000	3500
300-200	3V	5600	3700	1900	7100	6600	3800

Pump casing materials :cast iron or bronze: indications x 1,0
 nodular cast iron : indications x 1,5

10.10.2 Permissible forces and moments on the flanges - bearing group 4

Permissible forces and moments on the flanges, based on Europump*

CN	bearing bracket	Pump unit with a non-grouted base plate								Pump unit with a grouted base plate							
		Admissible forces suction flange [N]				Admissible moments suction flange [Nm]				Admissible forces suction flange [N]				Admissible moments suction flange [Nm]			
		Fx	Fy	Fz	Fr	Mx	My	Mz	Mr	Fx	Fy	Fz	Fr	Mx	My	Mz	Mr
CN 125-500	4	2700	2400	2200	4200	1300	850	900	1800	3950	3500	3200	6150	3000	1950	2100	4150
CN 150B-400	4	3350	3000	2700	5200	1800	1250	1450	2600	4900	4400	3950	7650	4650	3200	3750	6750
CN 150-500	4	3350	3000	2700	5200	1800	1250	1450	2600	4900	4400	3950	7650	4650	3200	3750	6750
CN 200-250	4	3350	3000	2700	5200	1800	1250	1450	2600	4900	4400	3950	7650	4650	3200	3750	6750
CN 200-315	4	3350	3000	2700	5200	1800	1250	1450	2600	4900	4400	3950	7650	4650	3200	3750	6750
CN 200-400	4	4000	3600	3200	6250	2400	1700	2000	3550	5850	5300	4700	9150	6750	4750	5600	9950
CN 250-250	4	4000	3600	3200	6250	2400	1700	2000	3550	5850	5300	4700	9150	6750	4750	5600	9950
CN 250-315	4	4000	3600	3200	6250	2400	1700	2000	3550	5850	5300	4700	9150	6750	4750	5600	9950
CN 300-250	4	4000	3600	3200	6250	2400	1700	2000	3550	5850	5300	4700	9150	6750	4750	5600	9950
CN 300-315	4	4000	3600	3200	6250	2400	1700	2000	3550	5850	5300	4700	9150	6750	4750	5600	9950

CN	bearing bracket	Pump unit with a non-grouted base plate								Pump unit with a grouted base plate							
		Admissible forces discharge flange [N]				Admissible moments discharge flange [Nm]				Admissible forces discharge flange [N]				Admissible moments discharge flange [Nm]			
		Fx	Fy	Fz	Fr	Mx	My	Mz	Mr	Fx	Fy	Fz	Fr	Mx	My	Mz	Mr
CN 125-500	4	1500	1650	1850	2900	700	300	100	750	2150	2400	2650	4150	1350	600	200	1500
CN 150B-400	4	1800	1800	2100	3300	900	450	400	1050	2600	2600	3050	4750	1900	950	850	2250
CN 150-500	4	1800	1800	2100	3300	900	450	400	1050	2600	2600	3050	4750	1900	950	850	2250
CN 200-250	4	2400	2200	2700	4200	1300	850	900	1800	3500	3200	3950	6150	3000	1950	2100	4150
CN 200-315	4	2400	2200	2700	4200	1300	850	900	1800	3500	3200	3950	6150	3000	1950	2100	4150
CN 200-400	4	2400	2200	2700	4200	1300	850	900	1800	3500	3200	3950	6150	3000	1950	2100	4150
CN 250-250	4	3000	2700	3350	5200	1800	1250	1450	2600	4400	3950	4900	7650	4650	3200	3750	6750
CN 250-315	4	3000	2700	3350	5200	1800	1250	1450	2600	4400	3950	4900	7650	4650	3200	3750	6750
CN 300-250	4	3600	3200	4000	6250	2400	1700	2000	3550	5300	4700	5850	9150	6750	4750	5600	9950
CN 300-315	4	3600	3200	4000	6250	2400	1700	2000	3550	5300	4700	5850	9150	6750	4750	5600	9950

Pump casing material: cast iron or bronze: indications x 1,0
 nodular cast iron: indications x 1,5

* Forces and moments allowed on Centrifugal Pump Flanges - Europump

10.11 Noise data

10.11.1 Pump noise as a function of pump power

The following data are based on normal use of the pump, driven by an electric motor.

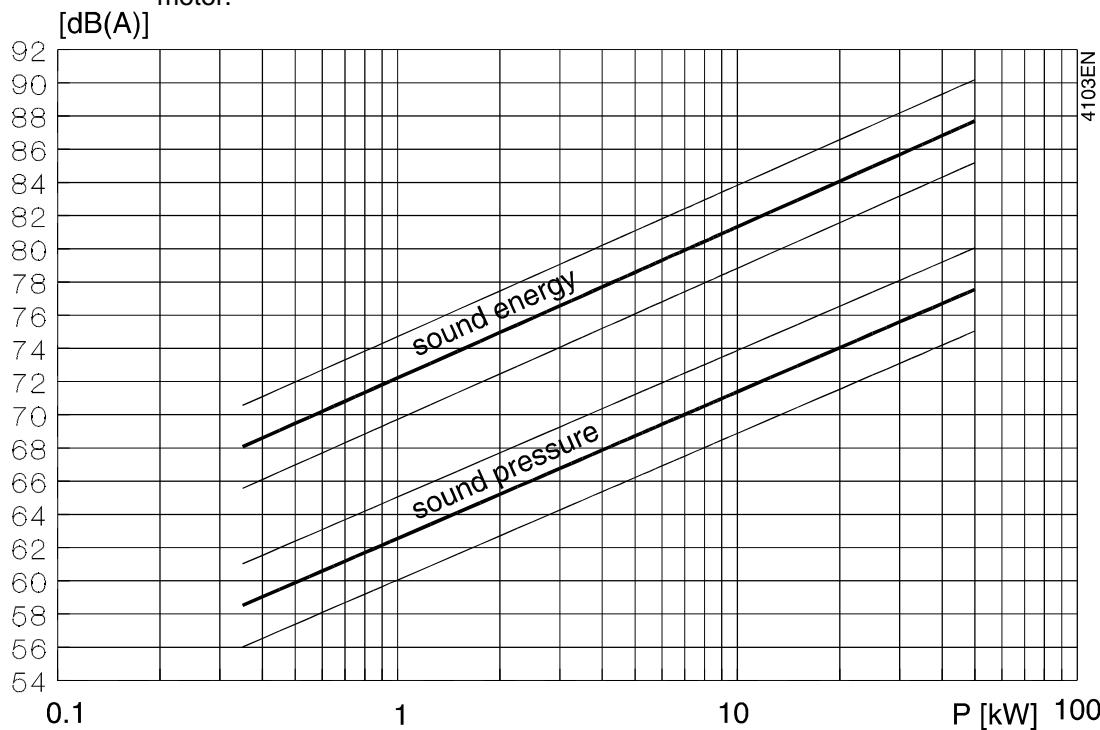


figure 70 Noise level as function of pump power [kW] at 1450 min^{-1} .

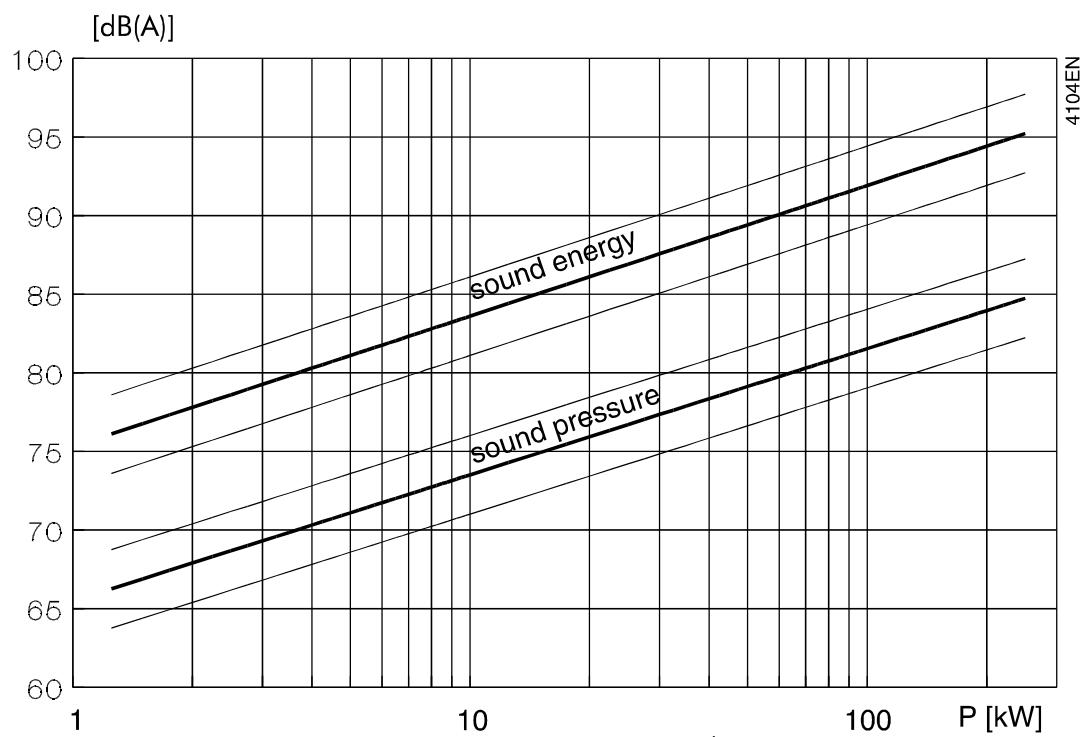


figure 71 Noise level as function of pump power [kW] at 2900 min^{-1} .

10.11.2 Noise

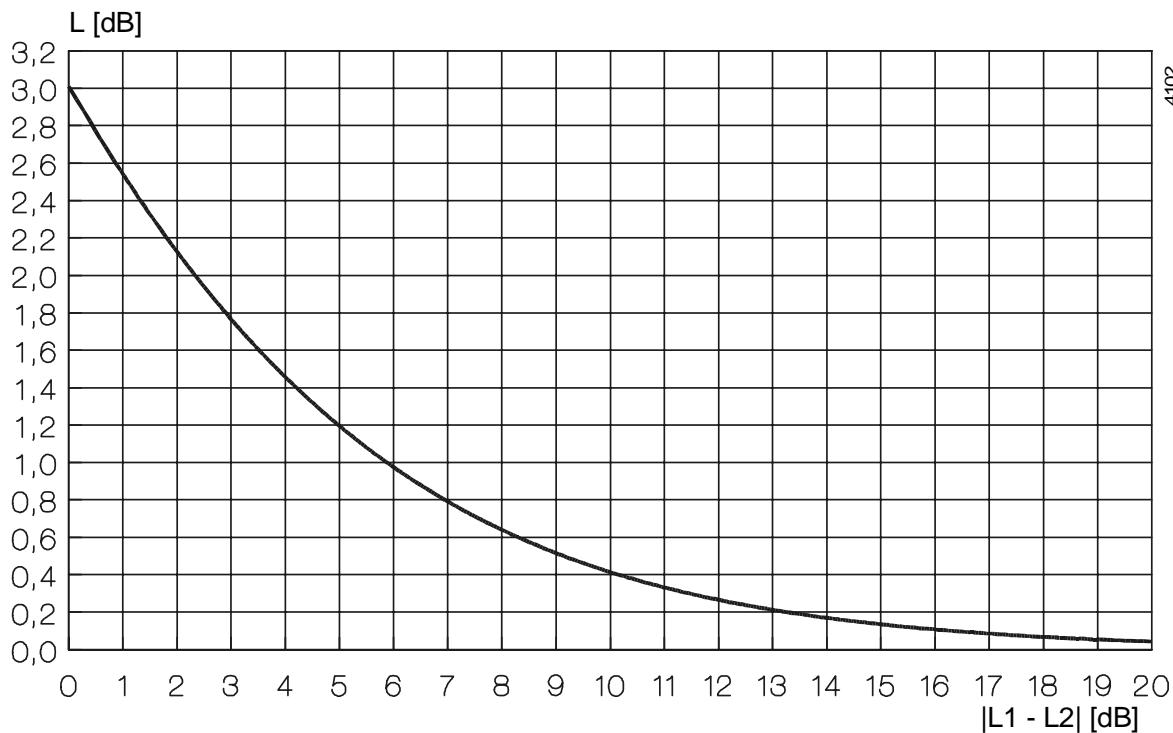


figure 72 Noise level entire pump unit.

In order to determine the total noise level of the entire pump unit, the noise level of the motor must be added to that of the pump. This can be easily done by using the graph above.

- 1 Determine the noise levels (L_1 and L_2), of the pump (using figure 70 or 71) and the motor.
- 2 Determine the difference between both levels $|L_1 - L_2|$.
- 3 Look for the differential value on the $|L_1 - L_2|$ -axis
- 4 Go up to the curve.
- 5 Go left to the L [dB]-axis
- 6 Read the value here.
- 7 Add the value found in 6 to the highest noise level (L_1 or L_2).

Example:

1. Pump 75 dB; motor 78 dB.
2. $|75-78| = 3$ dB.
3. 3 dB on the X-axis = 1,75 dB on the Y-axis.
4. Highest noise level + 1,75 dB = $78 + 1,75 = 79,75$ dB.

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